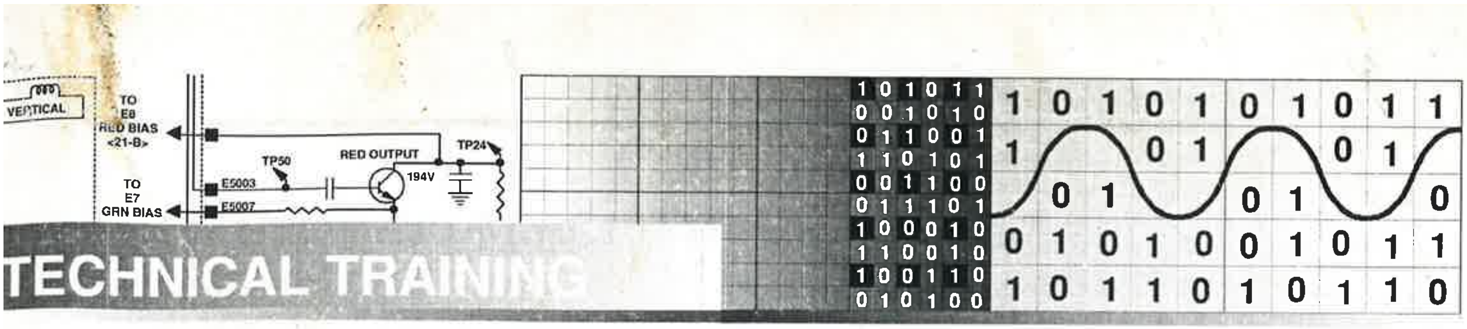
VERTICAL
TO E8 RED BIAS <21-B>
TO E7 GRN BIAS
E5003
E5007
TP50
RED OUTPUT
194V
TP24
TECHNICAL TRAINING

# MM/MMC/DTV Troubleshooting Guide

SCENIUM

RCA

GE

**Chassis Covered:**
**MM101/MMC101/MMC102**
**DTV306/DTV307**

**THOMSON** MULTI MEDIA

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# FOREWORD

This publication is intended to aid service technician in troubleshooting & servicing the MMC (MM101/MMC101/MMC102/DTV306/DTV307 chassis) family of chassis. This troubleshooting publication is designed to assist the technician in becoming familiar with chassis circuitry, increase confidence and improve overall efficiency in servicing the product. For indepth circuit description, refer to the MM101 Technical Training Manual (# **T-MM101-1**) and the MMC101/MMC102 Technical Manual (# **T-MMC101/102-1**).

***Note:*** This publication is intended to be used only as a training aid. It is not intended to replace service data. Thomson Electronic Service Information for these instruments contains specific information about parts, safety and alignment procedures and must be consulted before performing any service. The information in this manual is as accurate as possible at the time of publication. Circuit designs and drawings are subject to change without notice.

# SAFETY INFORMATION CAUTION

Safety information is contained in the appropriate Thomson multimedia Inc. Electronics Service Data (ESI). All product safety requirements must be complied with prior to returning the instrument to the consumer. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damages and may expose themselves and others to possible injury.

All integrated circuits, all surface mounted devices, and many other semiconductors are electrostatically sensitive and therefore require special handling techniques.

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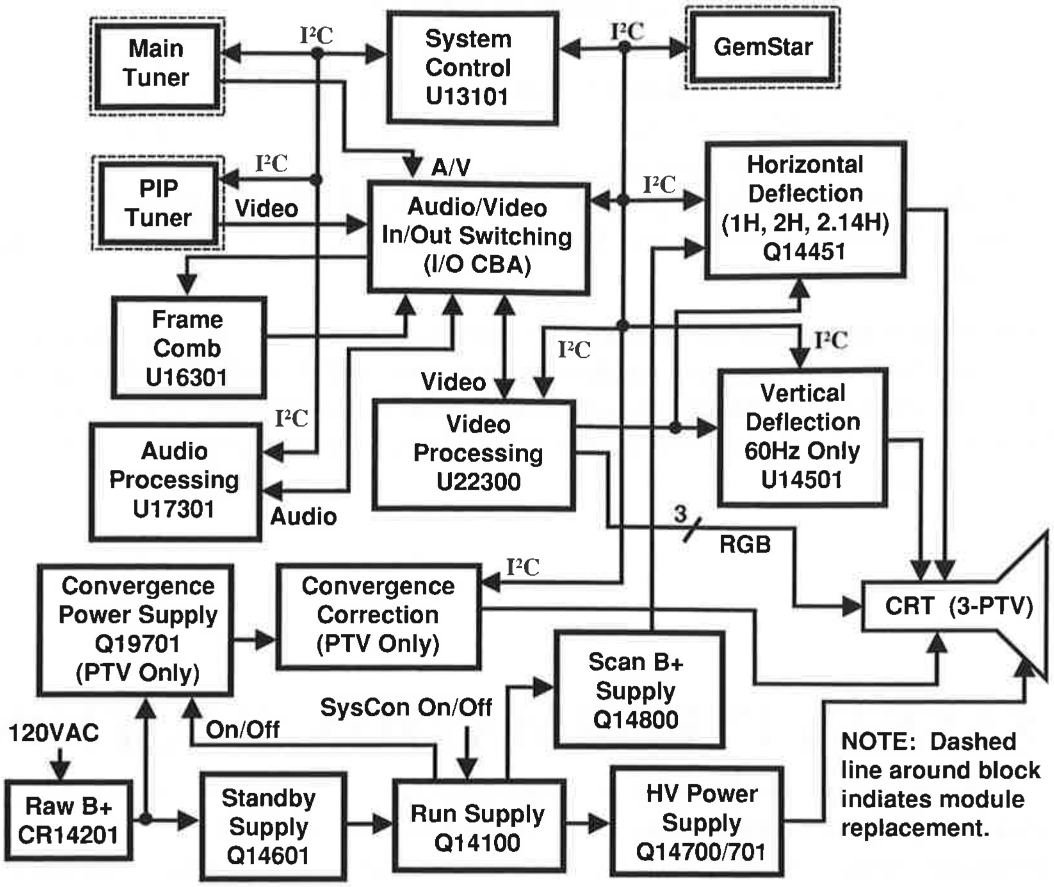
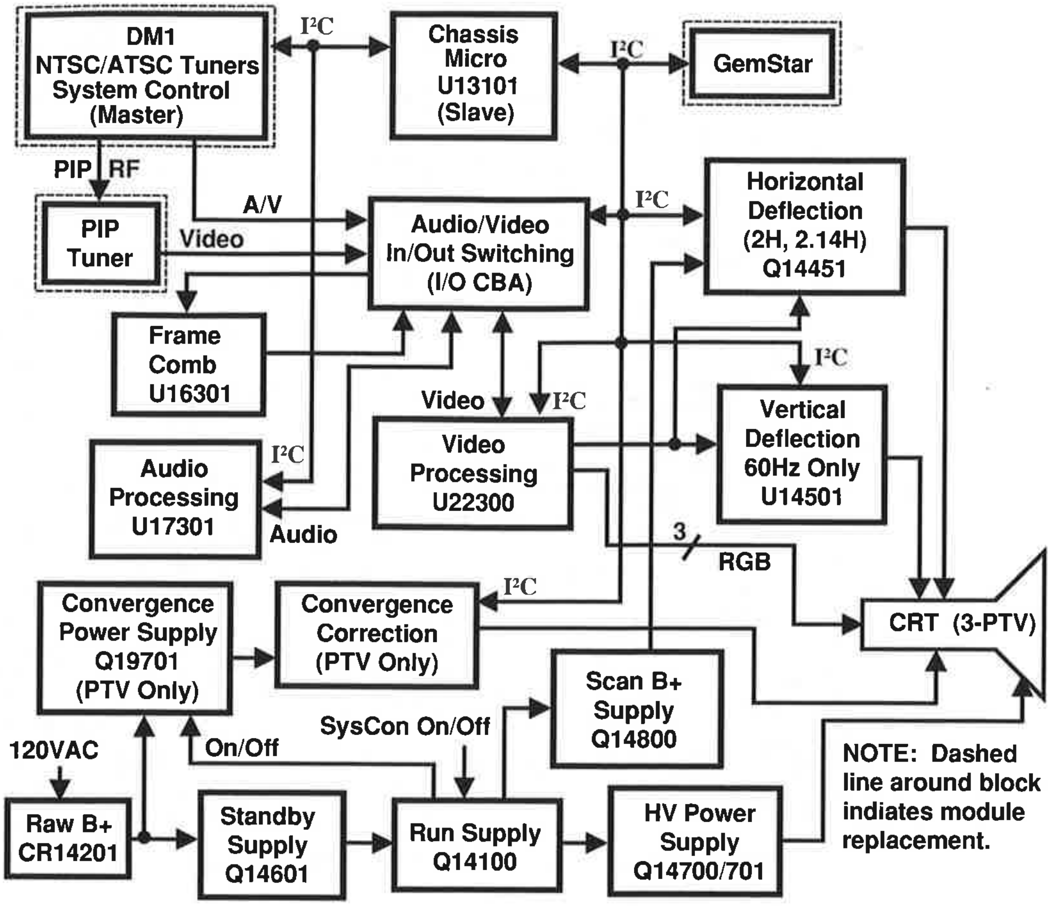
THOMSON MULTI MEDIA


Main Tuner
I²C
System Control U13101
I²C
GemStar
PIP Tuner
I²C
Video
A/V
Audio/Video In/Out Switching (I/O CBA)
I²C
Horizontal Deflection (1H, 2H, 2.14H) Q14451
Frame Comb U16301
I²C
Video
I²C
Vertical Deflection 60Hz Only U14501
I²C
Audio Processing U17301
Audio
Video Processing U22300
3
RGB
I²C
Convergence Power Supply Q19701 (PTV Only)
Convergence Correction (PTV Only)
CRT (3-PTV)
Scan B+ Supply Q14800
SysCon On/Off
120VAC
On/Off
NOTE: Dashed line around block indiates module replacement.
Raw B+ CR14201
Standby Supply Q14601
Run Supply Q14100
HV Power Supply Q14700/701

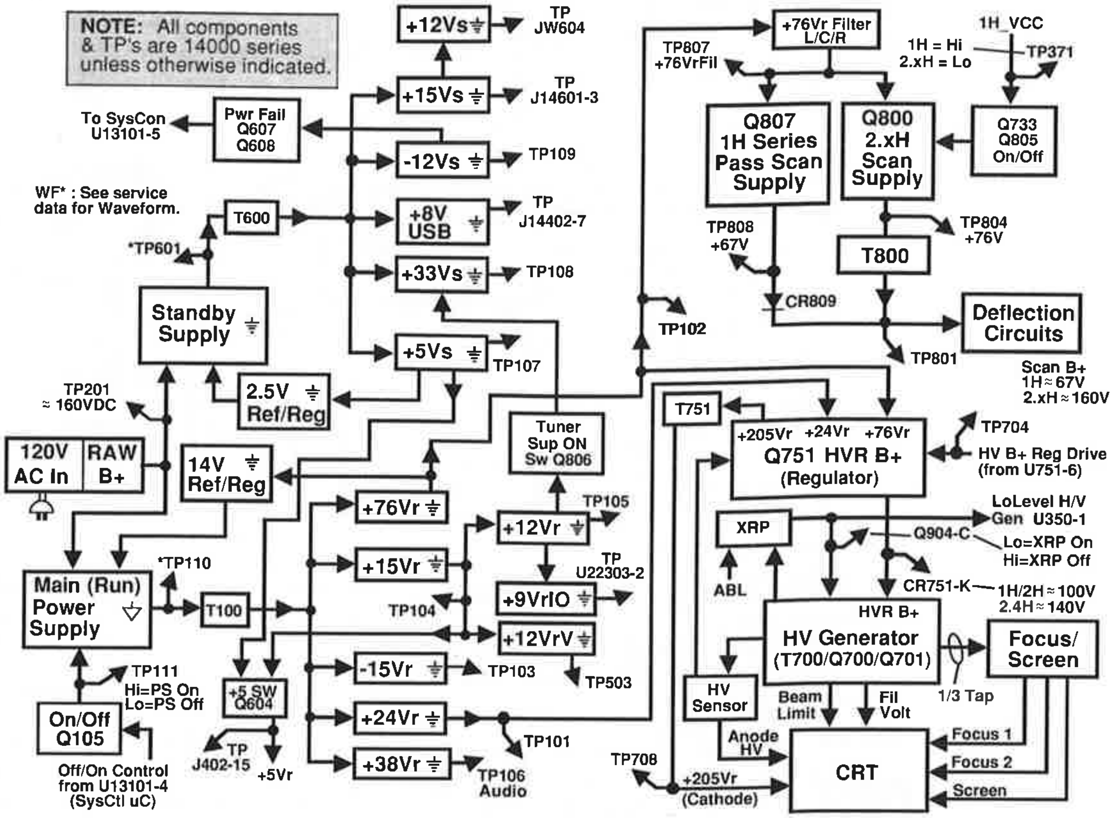
**MM101/MMC101/MMC102 System Block Diagram**

The MM/MMC and DTV family of chassis are unique in some ways but are fairly conventional in others. All of them are also very similar to one another. The video, audio processing and switching are virtually the same in all versions of the chassis. Also, all the chassis incorporate the GemStar module. All of the chassis use the same conventional switch mode power supply for both the Standby and Run Supplies. The vertical deflection is very similar in all the chassis. The only difference in the horizontal deflection circuits between the MM/MMC and the DTV is that the DTV chassis does not scan at 1H. The block diagram above and on the next page show the Convergence Power Supply and the Convergence Correction circuitry needed for the projection televisions, which of course would not be in the direct view instruments. The PTV deflection would also be slightly different in that there would be three horizontal and vertical deflection yokes instead of the one used in direct view sets. Another difference between the MM/MMC and DTV series is that the MM/MMC uses a conventional


DM1
NTSC/ATSC Tuners
System Control
(Master)
I²C
Chassis Micro U13101 (Slave)
I²C
GemStar
PIP
RF
PIP Tuner
A/V
Video
Audio/Video In/Out Switching (I/O CBA)
I²C
Horizontal Deflection (2H, 2.14H) Q14451
Frame Comb U16301
I²C
Video
I²C
Vertical Deflection 60Hz Only U14501
Audio Processing U17301
I²C
Video Processing U22300
Audio
3
RGB
Convergence Power Supply Q19701 (PTV Only)
Convergence Correction (PTV Only)
I²C
CRT (3-PTV)
Scan B+ Supply Q14800
SysCon On/Off
120VAC
On/Off
Raw B+ CR14201
Standby Supply Q14601
Run Supply Q14100
HV Power Supply Q14700/701
NOTE: Dashed line around block indiates module replacement.

DTV306 & DTV307 System Block Diagram

NTSC tuner while the DTV series utilizes the DM1 module which contains a NTSC, ATSC and DBS satellite tuners. All the chassis use a conventional NTSC tuner for PIP operation. A major difference between the MM/MMC/DTV series of chassis and a standard or conventional TV chassis is the 'Scan B+ Supply' and the 'HV Power Supply'. Because of the high performance requirements, both of these supplies are regulated supplies. In a conventional chassis, the HV (High Voltage) and Run B+'s were generated by the horizontal output devise and the IHVT while the Scan B+ was provided by the Standby Supply (Reg B+). It's important to realize that in this family of chassis, there are four (4) separate switch mode power supplies in the direct view and five (5) supplies in the PTV's. As with conventional chassis the Standby supply runs whenever the set has AC applied. The Run Supply turns on when the set powers up. In PTV's, the Run Supply then turns on the Convergence power supply. In all cases the Run Supply provides the B+'s for the Scan B+ Supply and the HV Power supply. If the Run Supply fails to start, the Scan B+ and HV supply will never come up.



NOTE: All components & TP's are 14000 series unless otherwise indicated.

WF* : See service data for Waveform.

+12Vs
TP JW604
+15Vs
TP J14601-3
To SysCon U13101-5
Pwr Fail Q607 Q608
-12Vs
TP109
T600
+8V USB
TP J14402-7
*TP601
+33Vs
TP108
Standby Supply
+5Vs
TP107
TP201 ≈ 160VDC
2.5V Ref/Reg
120V AC In
RAW B+
14V Ref/Reg
Tuner Sup ON Sw Q806
+76Vr
TP105
+12Vr
*TP110
Main (Run) Power Supply
T100
+15Vr
TP U22303-2
TP104
+9VrIO
+12VrV
TP111 Hi=PS On Lo=PS Off
+5 SW Q604
-15Vr
TP103
TP503
On/Off Q105
+24Vr
TP101
TP J402-15
+5Vr
+38Vr
TP106 Audio
Off/On Control from U13101-4 (SysCtl uC)
+76Vr Filter L/C/R
TP807 +76VrFil
1H_VCC
1H = Hi 2.xH = Lo
TP371
Q807 1H Series Pass Scan Supply
Q800 2.xH Scan Supply
Q733 Q805 On/Off
TP808 +67V
TP804 +76V
T800
CR809
TP102
Deflection Circuits
TP801
Scan B+ 1H≈67V 2.xH≈160V
T751
+205Vr +24Vr +76Vr
Q751 HVR B+ (Regulator)
TP704
HV B+ Reg Drive (from U751-6)
XRP
LoLevel H/V Gen U350-1
Q904-C
Lo=XRP On Hi=XRP Off
ABL
CR751-K
1H/2H≈100V 2.4H≈140V
HVR B+
HV Generator (T700/Q700/Q701)
Focus/ Screen
HV Sensor
Beam Limit
Fil Volt
1/3 Tap
Anode HV
Focus 1
TP708
CRT
Focus 2
+205Vr (Cathode)
Screen

Main-Standby Power Supply/Scan B+/HV Generator Block Diagram

## Power Supply Overview

The Standby, Main (or Run), Scan B+ and the High Voltage B+ power supplies in the MMC101, MMC102, DTV306 & DTV307 are functionally very similar to one another. The voltage levels, component designation and values may vary slightly but operation and troubleshooting are virtually the same. The troubleshooting procedures in this publication is intended to help the service technician in troubleshooting & servicing the four main power supplies. A brief overview of operation for each power supply is provided along with. For indepth circuit description, refer to the MM101 Technical Manual (# T-MM101-1) and the MMC101/MMC102 Technical Manual (# T-MMC101/102-1).

There are four independent supplies that provide power for the MMC101 family of multimedia chassis. They are the: Standby, Main (Run), Scan B+ and High Voltage B+. The block diagram above illustrates all four (4) of these power supplies and how they are generated. The standby and main supply voltages are primarily developed from the Raw B+. The standby and main (run) supplies operate independently of one another. The standby power supply operates whenever 120VAC is applied. The Main or run supply is only active when the instrument is turned on. The Scan B+ is a regulated B+ that is used by the deflection circuits and is developed from the +76Vr (run) supply after the run supply comes up. The HV Reg B+ is also an independent regulated supply that provides high voltage for the CRT and its circuitry. The HV Reg B+ is developed from the +24Vr and the +76Vr (run) supplies.

## General TroubleshootingTips

### Shut Down Modes:

No Start: If set is 'Dead', check standby and main (run) supplies first.
Pulsing Shutdown: Power Fail, XRP, Fan Detect, Horizontal Scan Loss, Scan B+ overvoltage, 2H Horz Overdrive, +12VSense

**TIP:** If 'pulsing Shutdown' (set tries to start 3 times but then shuts down) does not occur, problem is most likely in main (run) supply or standby supply. If 'pulsing shutdown" does occur, main & standby supplies are most likely OK.

**NOTE: The procedures below are not in any chronological order and are intended for general information only. Always use the troubleshooting procedure provided for the suspected circuit.**

- Obtain latest Chipper Check failure code and check circuit areas accordingly.

  **IMPORTANT: DO NOT** reinitialize the EEPROM at this time!

- Remove and secure CRT CBA to prevent burning the CRT when troubleshooting.
- Check that both Standby & Main power supplies are operating correctly; if not, refer to appropriate procedure.
- Disable the horizontal drive (Q14451) circuit and eliminate it as the cause by removing L14454. Bring up main (run) supply slowly (refer to appropriate procedure); if excessive current draw is eliminated, troubleshoot horizontal drive circuits.
- The HV B+ Regulator (Q14751) & HV B+ Generator (Q14700/701) can be disabled by removing L14760 (removes +76VrB from circuit). The 1H & 2H Scan B+ circuits are not affected. Bring up main (run) supply slowly (refer to appropriate procedure); if excessive current draw is eliminated, troubleshoot HV B+ Regulator & HV Generator circuits.
- Disable the Scan B+ circuits (1H & 2H) by temporarily cutting JW14802 & JW14803 (removes +76VrFIL from Q14800 & Q14807). Bring up main power supply slowly (refer to appropriate procedure); if excessive current draw is eliminated, troubleshoot Scan B+ circuits.

**(Continueed on Next Page)**

## General TroubleshootingTips Continued

**NOTE: The procedures below are not in any chronological order and are intended for general information only. Always use the troubleshooting procedure provided for the suspected circuit.**

- If an XRP shutdown is suspected (Chipper Check failure code will indicate Scan Loss Shutdown), temporarily cut JW14902 (or short Q14904 B-E); if set comes on, troubleshoot XRP circuit.
- Remove tuner B+ (disconnect cable J16508). If set starts, check tuner B+ supply &/or short on the supply.
- Remove audio B+ by disconnecting power cable on I/O circuit board (or cut JW14107). If set starts, check audio B+ supply &/or short on the supply.
- Cooling fans should always start when set is turned on. If not, troubleshoot fan detect drive circuits (Q41125 & Q14126).
- Unplugging the CRT cable from the I/O circuit board activates the +12VSense latching shutdown.
- If instrument is 'pulsing', check for a low at pin 3 of SysCon Micro U13101 (Scan Loss input). A low indicates set is in scan loss shutdown. Scan loss shutdown can be caused by several areas; +12VSense, XRP, or no horizontal scan, too much horizontal drive.
- Check for horizontal sweep at collector of Q14451. If not OK, check for horizontal signal (approx. 12Vpp) at pin 15 of connector P14406 referenced to cold ground. If not, present suspect deflection sip board. If sweep is present at the base of Q14451 but not the collector, suspect the Series Pass Regulator Q14807 (1H mode only).
- To force deflection circuits to 1H mode, perform the following: Defeat 2H Scan B+ power supply by shorting Q14805 collector to ground & short Q14445 Drain to ground. The 1H Series Regulator (Q14807) runs whenever deflection is on. SIP board may still be trying to run at 2H. This procedure only forces Scan B+ circuit to 1H mode.
- If a 'Fan Detect' failure code is obtained (pulsing shutdown) with Chipper Check, ensure that fans are not mechanically jammed (foreign object in fan, wrong service position, etc.).

**Power Supply Resistance to Ground**
*(All Measurements Taken with Set Unplugged)*

| *Test Point* | *Circuit* | *Resistance* |
|---|---|---|
| TP14108 | +33V Standby | 28K ohm |
| TP14107 | +5V Standby | 44 ohm |
| TP14109 | -12V Standby | 21K ohm |
| TP14807 | +76VrFil Run | 18K ohm |
| TP14102 | +76Vr (Main Reg DC) | 18K ohm |
| TP14106* | +31.5V Run (Audio) | 480 ohm |
| TP14101 | +24V Run | 1K ohm |
| TP14104 | +15V Run | 350 ohm |
| TP14105 | +12V Run | 1K ohm |
| TP14103 | -15V Run | 1.4K ohm |
| TP14503 | +12VrV (Vert) | 1.5K ohm |
| TP14504 | +12VrSIP (SIP CBA) | 1.4K ohm |
| TP14708 | Cathode B+ (205V) | 1.4M ohm |
| TP14801 | Scan B+ | 18K ohm |
| CR14751-K (EY14704) | HV Reg B+ | 65K ohm |

* Use audio return ground (JW14122) for measurement.

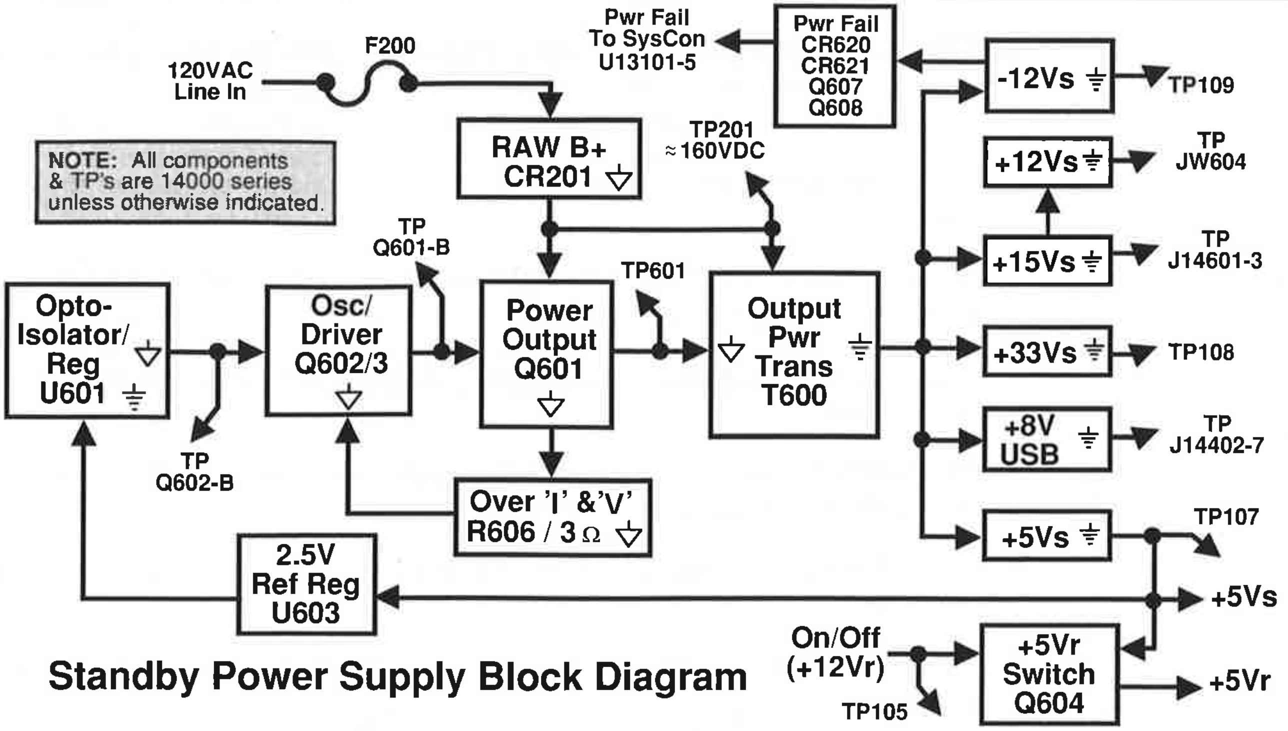
### *Deflection SIP Board Confirmation*

1. Obtain latest Chipper Check failure code and check circuit areas accordingly.

   **IMPORTANT: DO NOT** reinitialize the EEPROM!

2. If instrument is ‘cycling’, Standby & Main Supply are probably OK. If instrument is NOT ‘cycling’ (dead), verify all Standby & Main Supplies before continuing.
3. Remove & secure CRT CBA.
4. Apply power and turn instrument on.
5. Check that SIP board power supplies are present at J14102 (+12V pin 16 / -15V pin 5).
6. Check for horizontal drive signal at pin 15 of J14102.
7. If the horizontal drive signal is present (step 6), the Deflection SIP board is operating.

   ***NOTE:*** If set is cycling, the waveform will cycle.


120VAC
Line In
F200
RAW B+
CR201
TP201
≈160VDC
Pwr Fail
To SysCon
U13101-5
Pwr Fail
CR620
CR621
Q607
Q608
-12Vs
TP109
+12Vs
TP
JW604
+15Vs
TP
J14601-3
+33Vs
TP108
+8V
USB
TP
J14402-7
+5Vs
TP107
+5Vs
On/Off
(+12Vr)
TP105
+5Vr
Switch
Q604
+5Vr
Opto-
Isolator/
Reg
U601
TP
Q602-B
Osc/
Driver
Q602/3
TP
Q601-B
Power
Output
Q601
TP601
Output
Pwr
Trans
T600
Over 'I' &'V'
R606 / 3 Ω
2.5V
Ref Reg
U603

**NOTE:** All components & TP's are 14000 series unless otherwise indicated.

**Standby Power Supply Block Diagram**

## Standby Power Supply Overview

The ***Standby Supply*** provides power to all devices that need to remain "alive" when the main supply is off (TV Off). In addition, it must retain enough power to keep the microprocessor active during a "power fail" long enough to activate the "batten down the hatches" software routine. This allows for a controlled, sequential shutdown of the chassis before power disappears completely. This routine stores all customer settings and chassis alignments to the EEPROM. This enables the set to start normally after a power failure. The standby supply also provides a "Run" mode supply (+5Vr) during normal operation. The +8V USB supply is required even if the chassis is turned off in order to provide power for any USB devices downstream.

## *Troubleshooting the Standby Power Supplies (MMC101 Family)*

***CAUTION:*** **Always use an "Isolated VARIAC" on instrument in order to prevent serious damage to test equipment and/or instrument.**

1. Remove CRT CBA (s) and secure.
2. Check Q14601, Q14602, Q14603, F14200 & replace if suspect (if one has failed, replace all).
3. Check all other active components & replace if suspect.
4 When all parts check OK proceed to step 5.

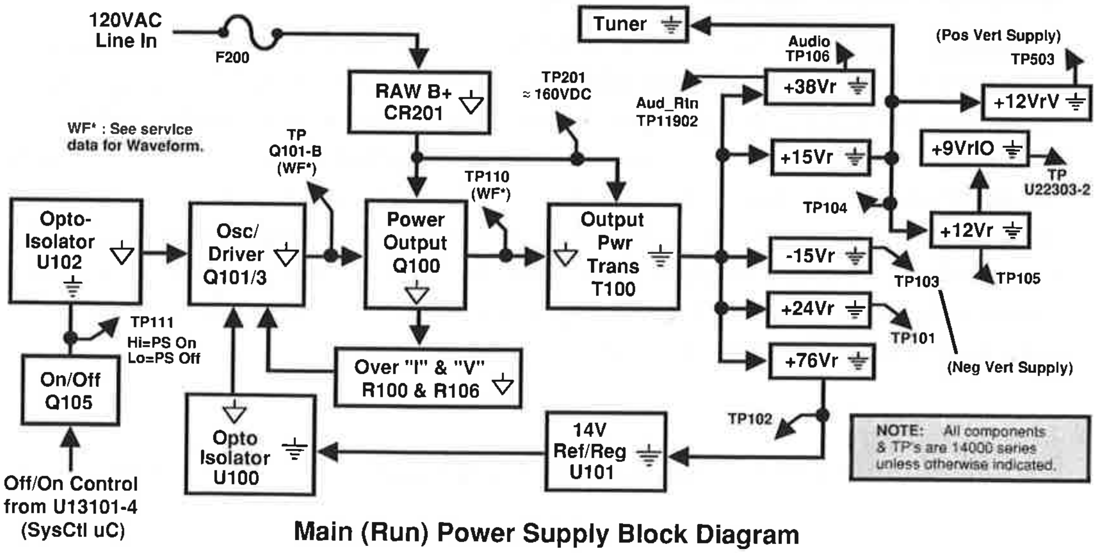
(Cont. on next page)

***CAUTION:*** To bring up power supply from 0VAC line, the Hi-Volt B+ Regulator Generator circuit should be shut down or damage may occur. Do this by removing L14760 (removes +76VrB from circuit).

5. Read CAUTION above. Bring up standby power supply from zero (0) AC line input.
6. Monitor Raw B+ (TP14201) & raise line voltage (use isolated VARIAC) slowly while monitoring AC line current.
7. If current exceeds ***.5 amp before AC In = 60, STOP*** & re-check all standby supply components.

**NOTE:** At 60VAC line voltage, the standby supplies voltages should be approximately 20% below nominal.

8. If a standby supply output is missing or low, check for load (short) on supply that is low .
9. If a standby supply output is high, check for a 'no load' (open) on the supply that is high.


120VAC
Line In
F200
RAW B+
CR201
TP201
≈ 160VDC
Tuner
Audio
TP106
Aud_Rtn
TP11902
+38Vr
(Pos Vert Supply)
TP503
+12VrV
WF* : See service
data for Waveform.
TP
Q101-B
(WF*)
TP110
(WF*)
+15Vr
+9VrIO
TP
U22303-2
TP104
+12Vr
Opto-
Isolator
U102
Osc/
Driver
Q101/3
Power
Output
Q100
Output
Pwr
Trans
T100
-15Vr
TP103
TP105
+24Vr
TP101
TP111
Hi=PS On
Lo=PS Off
+76Vr
(Neg Vert Supply)
On/Off
Q105
Over "I" & "V"
R100 & R106
TP102
Opto
Isolator
U100
14V
Ref/Reg
U101
NOTE: All components
& TP's are 14000 series
unless otherwise indicated.
Off/On Control
from U13101-4
(SysCtl uC)

Main (Run) Power Supply Block Diagram

## Main (Run) Power Supply Overview

The ***Main (Run) supply*** generates voltages for normal operation (TV ON) of all other circuits and components. The main supply operates in the "forward" conduction mode. Power is delivered to the secondary transformer windings during power transistor "ON" time when the magnetic fields are expanding, rather than during "OFF" time when the fields are. In addition, the +76Vr supply is used to generate a B+ supply for horizontal deflection operation and another B+ supply for high voltage operation.

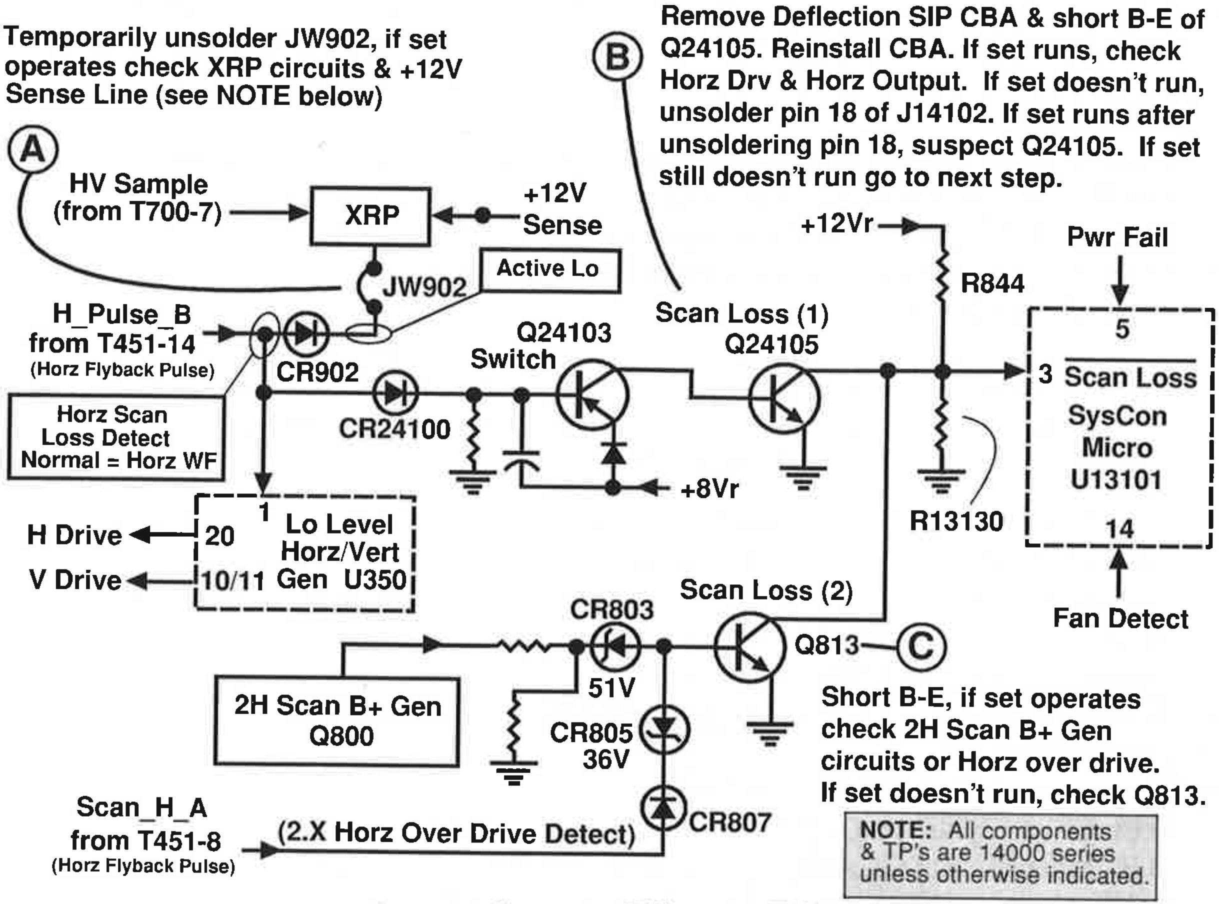
## *Troubleshooting the Main (Run) Power Supplies (MMC101 Family)*

***CAUTION:*** Always use "Isolated VARIAC" on instrument in order to prevent serious damage to test equipment and/or instrument.

1. Remove CRT CBA (s) and secure.
2. Check & verify ***"All"*** standby supplies are functioning correctly, if not troubleshoot standby supply that is wrong or missing.
3. Check Q14100, Q14101, Q14103 & replace if suspect (if one has failed, replace all).
4. Check all other active components & replace if suspect.
5. When all parts check OK proceed to step 6.

***CAUTION:*** To bring up power supply from 0VAC line, the HV B+ Regulator & HV Generator circuit must be shut down to prevent damage. Do this by removing L14760 (removes +76VrB from HV circuit).

6. Force the Main (Run) Power Supply ON by shorting B-E of Q14105 (cold side of Opto Isolator U14102) **or** ground pin 4 of the SysCon Micro U13101.
7. Monitor Raw B+ (TP14201) & +76Vr (TP14102), raise line voltage slowly while monitoring AC line current. At 60VAC line voltage, the main (run) supply voltages should be approx. 20% below nominal.
8. If current exceeds ***3 amps before AC In = 60, STOP*** & check for shorted load on main run supplies.
9. Check main (run) supplies, if ***NOT OK***:
   a) Check drive pulse on Q14100-Drain (TP14110).
   b) If drive pulse Not OK, recheck Q14100 & associated components.
   c) If drive pulse OK, check for defective +76Vr supply.
   d) If a supply is low, check for shorted load on supply that is low.
   e) If a supply is high, check T14100 (check for a 'no load/open' on the supply that is high.
   f) If +76Vr (TP14102) is approximately 60VDC then proceed.
10. Raise line voltage slowly until +76Vr regulates @ approx. +76V.
   a) If +76Vr exceeds approx. 78VDC, do not raise line voltage further, check U14101& U14100 & associated components.
   b) If 76Vr is OK, raise line voltage to 120VAC & check all main (run) supplies.
   c) Check input power (current); should be approx. 120W-180W at low brightness.
   d) Check Q14100 collector voltage; should be approx. 400V-500V (peak) at low brightness.
11. Remove AC power & remove short on Q14105 B-E (or remove ground from pin 1 of U13101).
12. Ensure that L14760 is reinstalled to enable HV.
13. Apply 120VAC & turn on chassis.
14. If chassis does not turn on, check –12Vs (TP14109).
   a) No –12Vs, troubleshoot –12Vs power supply.
   b) –12Vs OK, check Power Fail circuit (Q14607/608).
15. If the Power Fail & On/Off circuits check OK, troubleshoot System Control



A
HV Sample (from T700-7)
XRP
+12V Sense
JW902
Active Lo
H_Pulse_B from T451-14 (Horz Flyback Pulse)
CR902
Horz Scan Loss Detect Normal = Horz WF
CR24100
Q24103 Switch
Q24105
Scan Loss (1)
+8Vr
+12Vr
R844
R13130
Pwr Fail
5
3 Scan Loss
SysCon Micro U13101
14
Fan Detect
B
H Drive
V Drive
1
20
10/11
Lo Level Horz/Vert Gen U350
CR803
51V
Scan Loss (2)
Q813
C
2H Scan B+ Gen Q800
CR805 36V
CR807
Scan_H_A from T451-8 (Horz Flyback Pulse)
(2.X Horz Over Drive Detect)

Temporarily unsolder JW902, if set operates check XRP circuits & +12V Sense Line (see NOTE below)

Remove Deflection SIP CBA & short B-E of Q24105. Reinstall CBA. If set runs, check Horz Drv & Horz Output. If set doesn't run, unsolder pin 18 of J14102. If set runs after unsoldering pin 18, suspect Q24105. If set still doesn't run go to next step.

Short B-E, if set operates check 2H Scan B+ Gen circuits or Horz over drive. If set doesn't run, check Q813.

NOTE: All components & TP's are 14000 series unless otherwise indicated.

**Scan Loss Block Digram**

**NOTE: Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damages and may expose themselves and others to possible injury.**

## Scan Loss Detect Overview

The Scan Loss detect circuit monitors not only horizontal scan loss but also XRP, +12V Sense, horizontal drive level (overdrive), Scan B+ overvoltage and loss of horizontal drive. Horizontal scan is monitored at the anode of CR24100. If horizontal scan is lost, the base of Q24103 is pulled low turning it on. This turns on Q24105, pulling the Scan Loss input (pin 3) of the System Control micro low and shutting down the set (pulsing shutdown). The XRP and +12V Sense circuit, when activated, pulls the anode of CR24100 low via CR902 and causes scan loss shutdown. Scan B+ is monitored for overvoltage by CR803 (51V zener). If Scan B+ rises too high, CR803 breaks over and turns on Q813, which pulls pin 3 of the System Control micro low shutting down the instrument. Horizontal overdrive is detected by a pulse from T451-8 and is applied to CR807 which acts as a rectifier. If the DC voltage on the cathode of CR807 rises above 36 volts, CR805 (zener) breaks over and again Q813 turns on pulling pin 3 low. Two (2) other shutdown inputs to the system control are the Power Fail input at pin 5 and the Fan Detect input at pin 14 of U13101 (System Control Micro). The Power Fail and Fan Detect inputs also cause a pulsing shutdown when activated.

## Troubleshooting Scan Loss Detect

1. Remove CRT CBA (s) and secure.

2. Obtain latest Chipper Check failure code and check circuit areas accordingly.

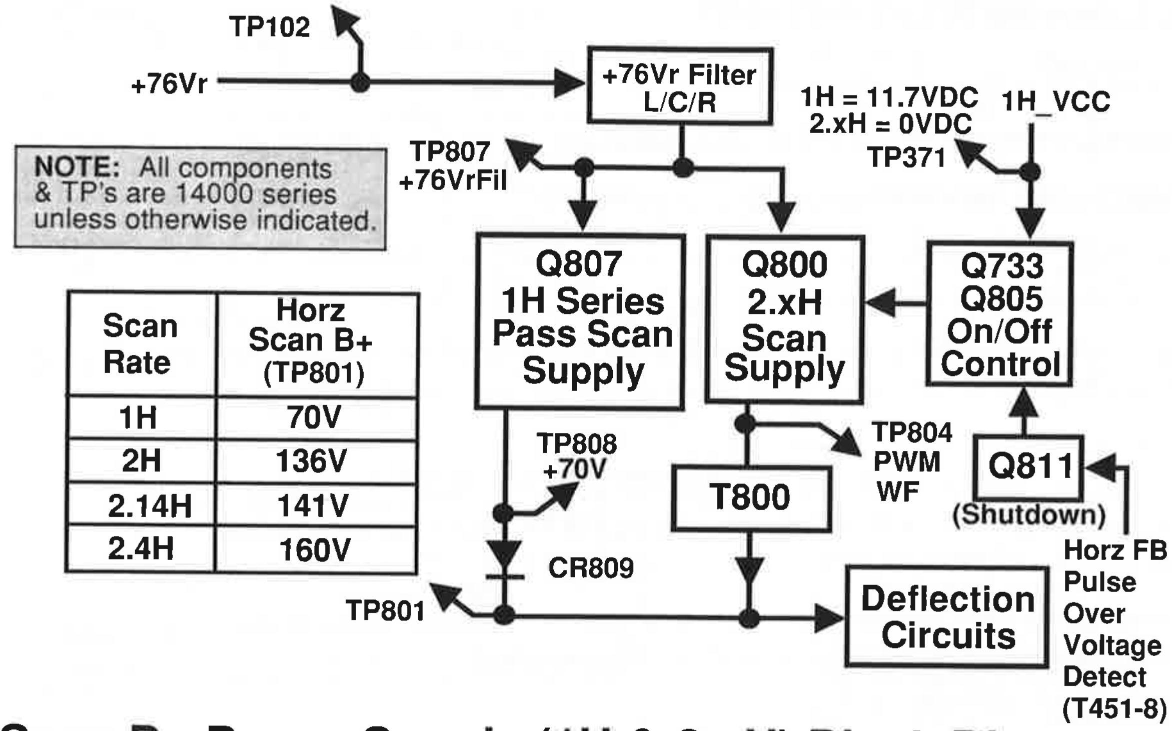
**IMPORTANT: DO NOT** reinitialize the EEPROM!

3. Temporarily unsolder JW14902, if set operates check XRP circuits and +12V Sense Line. If set does not operate, proceed to step 4.

4. Remove Deflection SIP CBA and short B-E of Q24105 (defeats scan loss input to U13101-3). Reinstall CBA. If set runs, check horizontal drive and horizontal output circuits.

5. If set doesn't run, unsolder pin 18 of J14102 (removes Scan Loss output from Deflection SIP CBA). If set runs after unsoldering pin 18, suspect Q24105. If set still does not run, proceed to next step.

6. Short B-E of Q14803. If set operates, check 2H Scan B+ Generator circuits and Horz Overdrive detect input. If set still doesn't run, check Q14813.


TP102
+76Vr
+76Vr Filter L/C/R
TP807 +76VrFil
1H = 11.7VDC
2.xH = 0VDC
1H_VCC
TP371
Q807 1H Series Pass Scan Supply
Q800 2.xH Scan Supply
Q733 Q805 On/Off Control
TP808 +70V
TP804 PWM WF
T800
Q811
(Shutdown)
CR809
TP801
Deflection Circuits
Horz FB Pulse Over Voltage Detect (T451-8)

**NOTE:** All components & TP's are 14000 series unless otherwise indicated.

| Scan Rate | Horz Scan B+ (TP801) |
|---|---|
| 1H | 70V |
| 2H | 136V |
| 2.14H | 141V |
| 2.4H | 160V |

Scan B+ Power Supply (1H & 2.xH) Block Diagram

## Scan B+ Power Supply Overview

In order to accurately scan at different frequencies, a separate regulated ***Scan B+ Power Supply*** system is used for the horizontal scan system. The primary power source for the Scan B+ supply is from the +76Vr supply. The system can be divided into two major blocks. First is the Series Pass Scan Supply (Q807—TP808) which generates the B+ used by horizontal scan circuits for 1H frequencies. Next, is the Switch Mode Scan B+ Supply (Q800—TP804). This supply provides B+ for horizontal scan frequencies of 2H and above. It is turned Off when the instrument is running in the 1H mode.

## *Troubleshooting 1H Series Pass Scan B+ Supply (Q14807)*

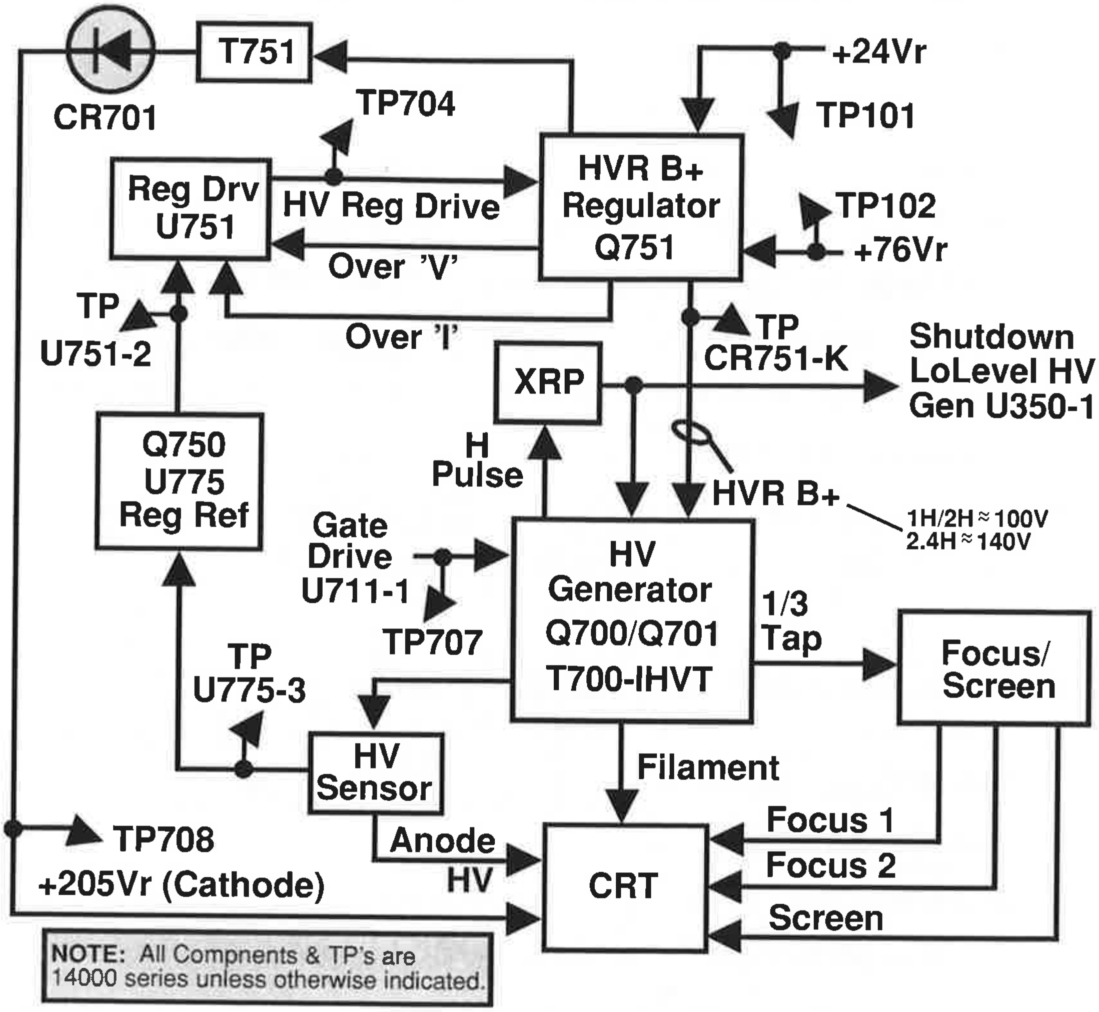
1. Obtain latest Chipper Check failure code and check circuit areas accordingly.

   **IMPORTANT: DO NOT** reinitialize the EEPROM!
2. Remove & secure CRT CBA.
3. Disable Horz Output Q14451 by removing L14454 (removes B+ from Q14451).
4. Disable Scan Loss Detect on the Main CBA by shorting B-E of Q14813.
5. Unsolder pin 18 of J14102 (defeats Scan Loss Detect from deflection SIP CBA).
6. Force instrument to 1H by unsoldering pin 9 of J14102 (Deflection SIP CBA).
7. Turn instrument on and measure Scan B+ voltage (TP14801); should be approximately 65-75VDC.
8. If Scan B+ NOT OK, check Q14807 & Q14809 and their associated circuitry.
9. If Scan B+ OK, check Horizontal Drive circuit (Q14451).

## *Troubleshooting 2H Scan B+ Supply (Q14800)*

1. Obtain latest Chipper Check failure code and check circuit areas accordingly.

   **IMPORTANT: DO NOT** reinitialize the EEPROM!
2. Remove & secure CRT CBA.
3. Disable Horz Drive Q14451 by removing L14454 (removes B+ from Q14451).
4. Disable Scan Loss Detect on Main CBA by shorting B-E of Q14813.
5. Unsolder pin 18 of J14102 (defeats Scan Loss Detect from deflection SIP CBA).
6. Force instrument to 2H by grounding pin 9 of J14102 (Deflection SIP CBA).
7. Turn instrument on and measure Scan B+ voltage (TP14801), should be between 130-170VDC.
8. If Scan B+ = 130-170VDC (2H Scan B+ supply is operational), check collector circuit of Q14451 and yoke return circuitry.
9. If horizontal collector circuit checks OK, check for horizontal drive from Deflection SIP CBA.
10. Check Q14805 and associated components (should only be turned on during 1H mode).
11. Verify that Q14811 is turned off (always OFF except during scan loss shutdown).
12. If Q14805 & Q14811 checks OK, go to next step.
13. If Scan B+ (TP14801) is below 130, check 2H Scan B+ generator and Regulator circuits (Q14800/801/802/804) if suspect replace all active devices.


CR701
T751
TP704
+24Vr
TP101
Reg Drv U751
HV Reg Drive
HVR B+ Regulator Q751
TP102
+76Vr
Over 'V'
TP U751-2
Over 'I'
TP CR751-K
Shutdown LoLevel HV Gen U350-1
XRP
Q750 U775 Reg Ref
H Pulse
HVR B+
1H/2H ≈ 100V
2.4H ≈ 140V
Gate Drive U711-1
TP707
HV Generator Q700/Q701 T700-IHVT
1/3 Tap
Focus/ Screen
TP U775-3
HV Sensor
Filament
TP708
+205Vr (Cathode)
Anode HV
CRT
Focus 1
Focus 2
Screen
NOTE: All Compnents & TP's are 14000 series unless otherwise indicated.

High-Voltage Power Supply Block Diagram

## High Voltage Power Supply Overview

The power source for the Hi-Volt B+ Regulator (Q750 & Q751) is the +76Vr and the +24Vr supplies. The HV B+ Regulator also generates a +210Vr supply for CRT bias operation. The HV B+ Regulator develops a regulated B+ that is applied to the HV Generator (Q700/Q701/T700). The HV Generator is responsible for developing the required "regulated" high voltage power supplies that is needed for CRT operation. The output from HV Generator is tapped off to provide the anode, focus and screen voltages for the CRT.

## *Troubleshooting the HV B+ Regulator (Q14751 &U14751)*

1. Obtain latest Chipper Check failure code and check circuit areas accordingly.

   **IMPORTANT: DO NOT** reinitialize the EEPROM!
2. Remove CRT CBA (s) and secure.
3. Force on the main (run) supply by shorting Q14105 B-E.
4. Check that +76Vr (TP14102) & +24Vr (TP14101) are OK.
5. Check CRT supply for 205VDC (TP14708). If approx. +76Vr, check HV B+ Regulator (Q14751 & U14751) and associated components.
6. If TP14708 (205VDC) is greater than +76Vr, HV B+ regulator is running but not regulating. Check U14775, U14750 & Q14750, and associated components.

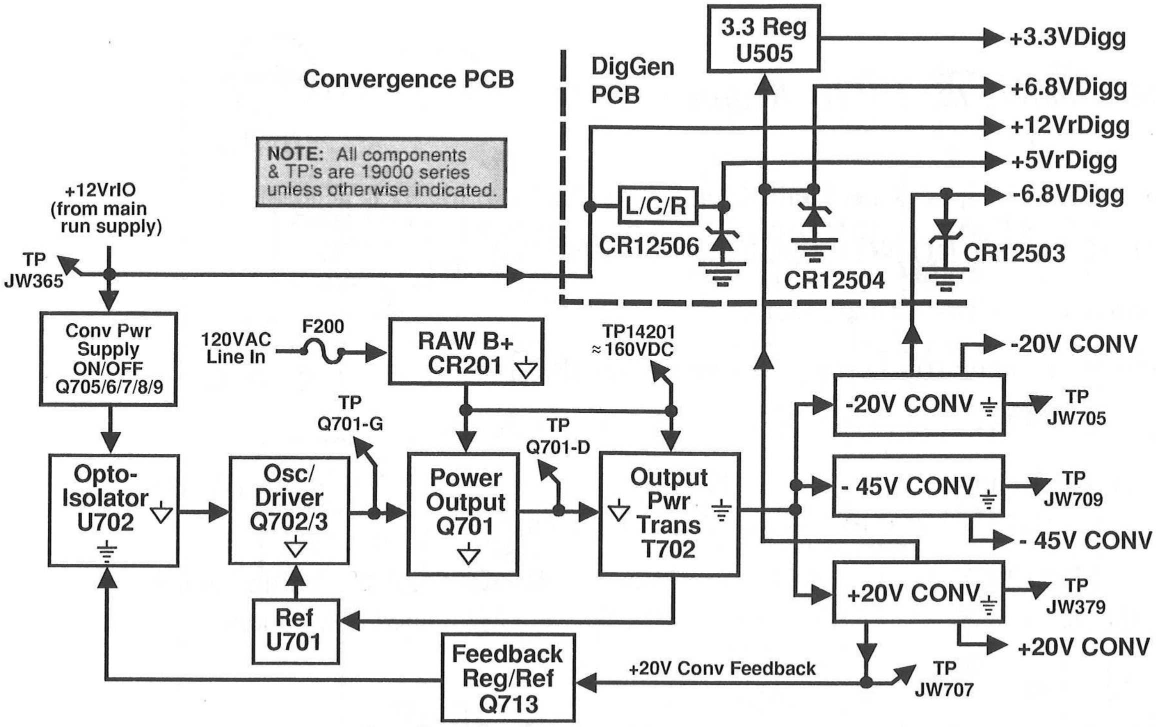
## *Troubleshooting the HV Generator (Q14700 & Q14701)*

*The procedure below allows the High Voltage Generator (Switch Mode Supply) to be operated independent of other supplies.*

**NOTE:** Disconnecting feedback (HV Sensor feedback-R14767) from the input of regulator circuit (U14775-3) allows the circuit to self-regulate.

1. Obtain the latest Chipper Check failure code and check circuit areas accordingly.

   **IMPORTANT: DO NOT** reinitialize the EEPROM!
2. Remove CRT CBA (s) and secure.
3. Force ***OFF*** the main (run) supply by disabling Q14100 (jumper JW14102 to "cold" ground)
4. Short Pins 2 & 9 of T14600 (connects hot to cold ground)
5. Jumper Raw B+ (TP14201) to pin 1 of T14700 (IHVT)
6. Connect external 16VDC supply to cathode of CR14112 (provides B+ for U14711)
7. Set AC Variac to zero. Monitor pin 1 of T14700 and slowly increase AC Variac until 90VDC is measured at pin 1.
8. HV Generator (32KV) should run and drive signals should be present.


Convergence PCB
DigGen PCB
NOTE: All components & TP's are 19000 series unless otherwise indicated.
3.3 Reg U505
+3.3VDigg
+6.8VDigg
+12VrDigg
+5VrDigg
-6.8VDigg
L/C/R
CR12506
CR12504
CR12503
+12VrIO (from main run supply)
TP JW365
Conv Pwr Supply ON/OFF Q705/6/7/8/9
120VAC Line In
F200
RAW B+ CR201
TP14201 ≈160VDC
-20V CONV
TP JW705
-20V CONV
TP Q701-G
TP Q701-D
Opto-Isolator U702
Osc/ Driver Q702/3
Power Output Q701
Output Pwr Trans T702
- 45V CONV
TP JW709
- 45V CONV
+20V CONV
TP JW379
+20V CONV
Ref U701
Feedback Reg/Ref Q713
+20V Conv Feedback
TP JW707

MMC102 DigiCon (Switch Mode) Power Supply Block Diagram

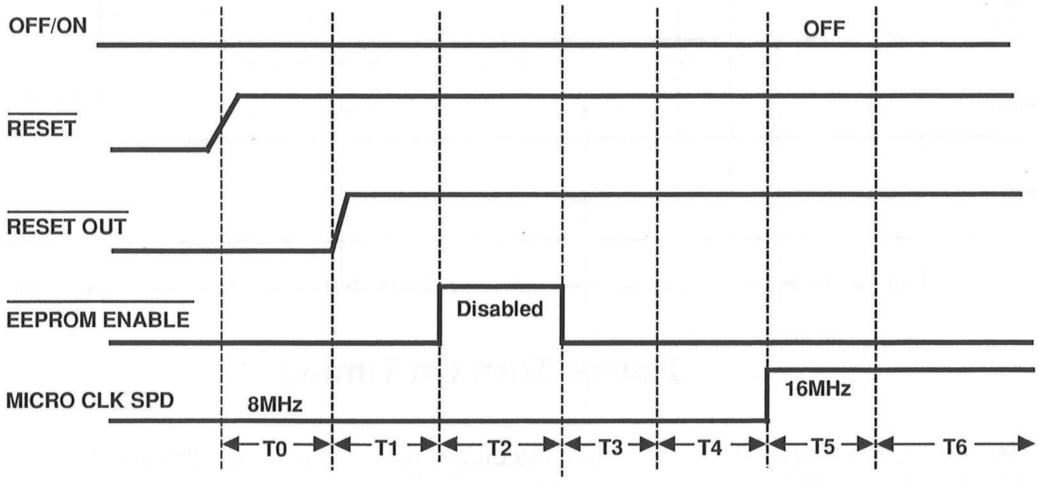
## DigiCon Power Supply Overview

The digital convergence power supply utilized in the MMC102 chassis is a switch mode supply that is very similar to other supplies used in the MM101 family of multi-media chassis. The on/off signal for the supply is the +12Vr (run) supply from the main chassis. Raw B+ from the chassis is applied directly to the output transistor Q701. The oscillator Q702/703 drives Q701. The output of Q701 is coupled through transformer T702 and generates three (3) primary convergence power supplies, +20V Conv, -45V Conv and –20V Conv. The +20V Conv is used as the feedback reference voltage for regulation (via Q713). The regulator/reference signal is applied to the opto-isolator (U702) whose output is applied to the osc/driver circuit which in turn controls the duty cycle of the power supply. The opto-isolator is used to isolate hot from cold ground on the input side. The transformer T702 provides this isolation on output side. The +20V Conv and –20V Conv supplies along with the +12Vr supply are routed directly to the Digital Generator circuit board where various other lesser supplies are developed.

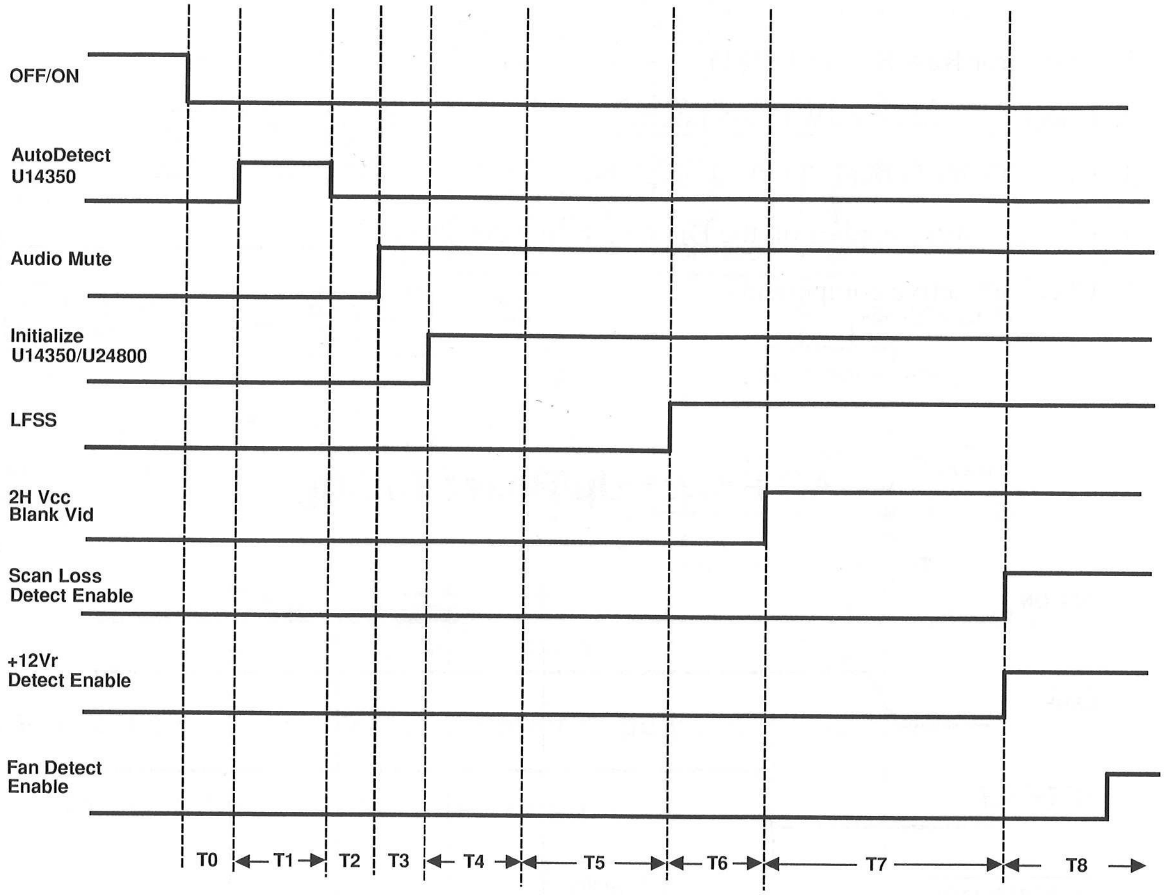
## *Troubleshooting the DigiCon Power Supply*

1. Check for Raw B+ (TP14201)
2. Check for +12Vr at JW14365 (start)
3. Check On/Off circuit (Q705 thru Q709)
4. Check Power Supplies on the DigiCon Generator PCB
5. Check all active components

## AC Power Up/Reset Timing



***T0:*** Micro resets either after the application of AC power, or after a reset condition ( 8 msec). The RESET line transitions from Lo to Hi, the RESET OUT line is inactive. The condition of OFF/ON is ignored, EEPROM ENABLE remains Lo and the micro clock speed is low (9MHz).
***T1:*** Provides 10-15 msecs and allows any EEPROM write operations to finish.
***T2:*** Disables any EEPROM writes and waits 10-12 msecs to see if the EEPROM power supply is decaying.
***T3:*** Wait time (1-2 msec) for the EEPROM supply to stabilize.
***T4:*** Is a 12 msec delay just before the micro internal clock switches to 16 MHz.
***T5:*** 16MHz clock is enabled and software begins to check chassis conditions. IR receiver and display drivers are initialized. The ATE mode is strobed to see if it is being requested and all other interrupts are setup. RAM and user registers are zeroed and a wait state is reached until the POWER FAIL input is OK.
***T6:*** The "batten" information is read from the EEPROM, OFF/ON remains in the Off state and all software modules are initialized in preparation for turn on.
If shutdown not operator initiated, the 15 second timer is read. If it is OK, set is automatically turned back on. If it is not, the Off state is set.


OFF/ON
AutoDetect U14350
Audio Mute
Initialize U14350/U24800
LFSS
2H Vcc Blank Vid
Scan Loss Detect Enable
+12Vr Detect Enable
Fan Detect Enable
T0
T1
T2
T3
T4
T5
T6
T7
T8

Power Turn On Timing

*T0:* Is typically 4.5 msec. During this time, the off/on line switches to on, the display drivers and user interface are initialized and software checks auto setup to see if it has ever been performed.

*T1:* Varies from 20 to 400 msec for the +12V run supply to rise above 80% of its normal operating voltage and for the deflection controller to be recognized.

During T2, approx. 25 msec, U24800 (Deflection Controller) is reset.

*T3:* 20-25 msec system delay.

*T4:* Initialize U24800 & U32602(main tuner DAC).

*T5:* 85 msec system delay.

*T6:* Turn on Horizontal Output, LFSS (Line Frequency Start-Stop).

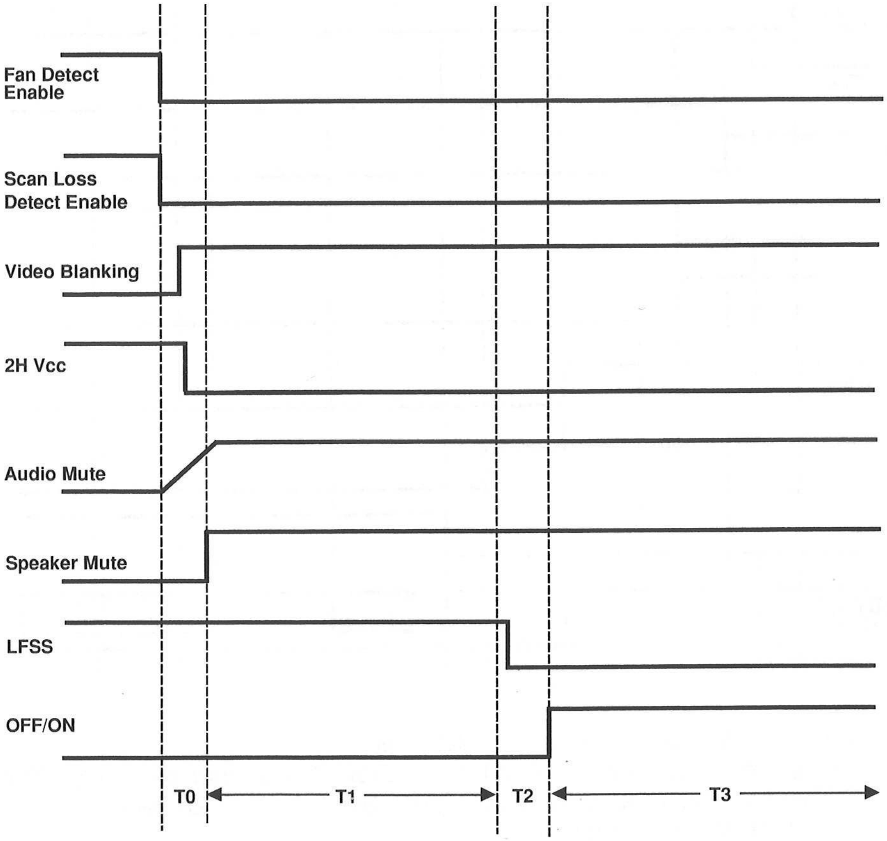
*T7:* Initialize the 2H power based on current video mode. Initialize F2PIP, Video control, and the video (VGA Sync) bus expander. Enable Scan Loss Detect, +12V Run Detect and Periodic Refresh (approx. 300 msec).

*T8:* Wait approximately 6000 msec for the fan detect circuitry to stabilize.

Once the turn on sequence is complete, certain operational monitors are enabled to ensure everything operates within specifications. These are:

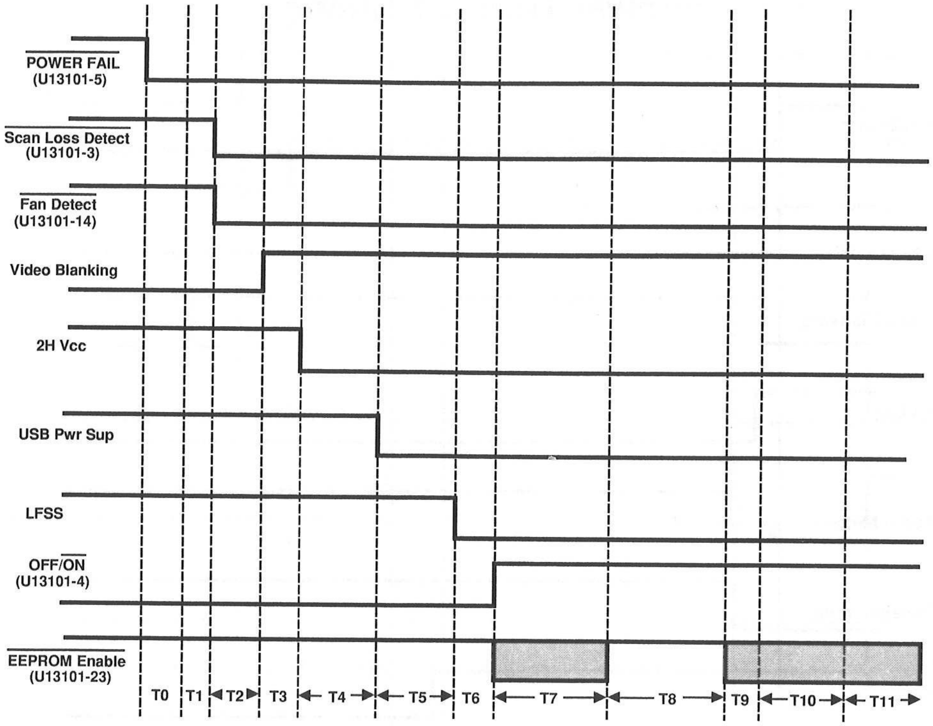
-- Scan Loss interrupt
-- Fan Detect
-- +12V Run Supply Detect (sampled periodically).

## Power Turn Off Timing


Fan Detect Enable
Scan Loss Detect Enable
Video Blanking
2H Vcc
Audio Mute
Speaker Mute
LFSS
OFF/ON
T0
T1
T2
T3

***T0:*** A 15 msec time period immediately following a turn off command, OSD is blanked, audio is gradually decreased to 0 db, the F2PIP IC is shut down, video switching is disabled, the tuner is shut down and the low level scan generator is turned off, disabling deflection and high voltage. If chassis in service test mode, test mode is terminated.
***T1:*** (200msec) speaker muting is applied to prevent annoying audio pops as the run supplies begin to decay.
***T2:*** After approximately 1 msec LFSS is set to stop and all the microprocessor PWM outputs are shut off. The Off/On output switch is set to Off.
***T3:*** System delay of 2 seconds to ignore any turn on commands until the turn off cycle is complete and all supplies have decayed enough to allow normal turn on.

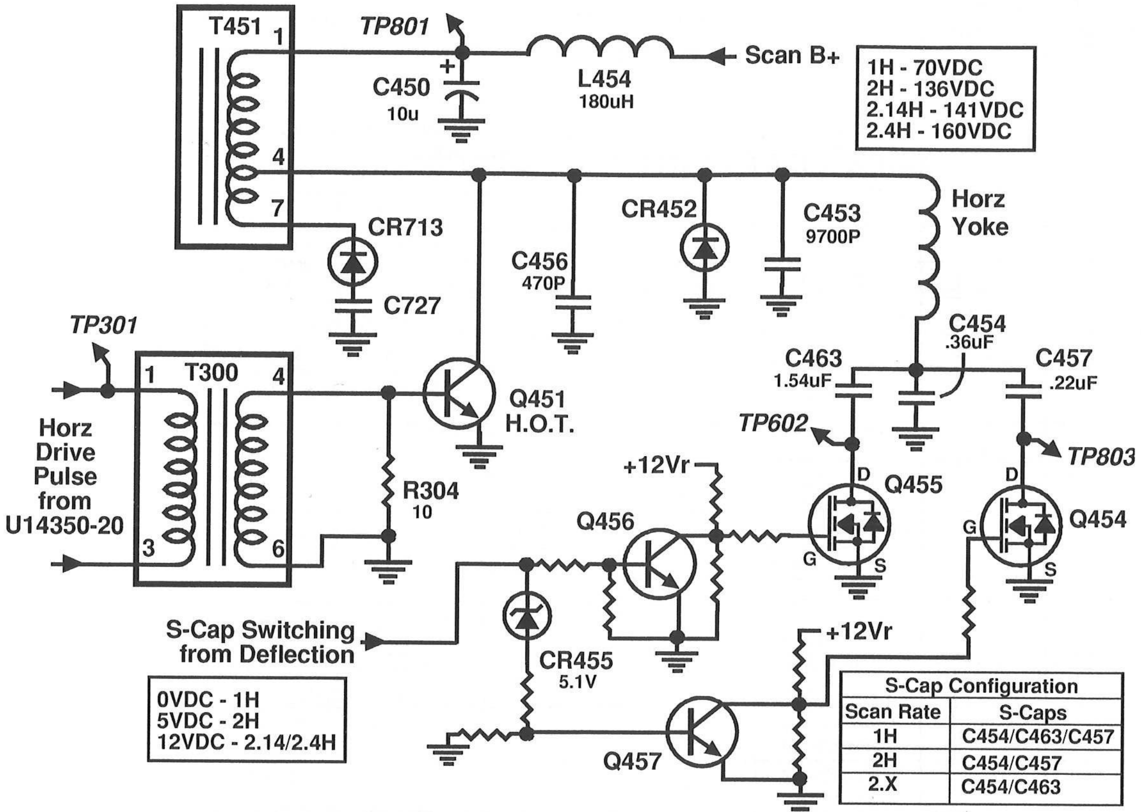
## Power Fail Shutdown Timing


POWER FAIL
(U13101-5)
Scan Loss Detect
(U13101-3)
Fan Detect
(U13101-14)
Video Blanking
2H Vcc
USB Pwr Sup
LFSS
OFF/ON
(U13101-4)
EEPROM Enable
(U13101-23)
T0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11

***T0:*** Wait until interrupts are enable (≈ 1.5msec)  
***T1:*** Wait for end of current EEPROM write. Stop IIC Communications (≈ .5msec)  
***T2:*** Disable Fan Detect & Scan Loss Detect. Blank OSD (≈ 2msec)  
***T3:*** Turn off 2H Vcc (≈ 1.5msec)  
***T4:*** Disable USB downstream ports (≈ 2msec)  
***T5:*** Turn off horizontal scan (≈ 3msec)  
***T6:*** System delay. Set On/Off to Off (≈ .5msec)  
***T7:*** Inialize micro data ports, disable data slicer. Set clock to 8MHz & turns off all micro A/D & PWM ports. Wait for last EEPROM write to finish (≈13msec)  
***T8:*** Disable EEPROM write (≈ 13.3msec)  
***T9:*** Wait for EEPROM supply to stablize (≈ 1.3msec)  
***T10:*** Write "Batten Down" data to EEPROM (≈ 8.4msec)  
***T11:*** Wait for supplies to fail (≈ 100msec)

## Chipper Check Error Codes

| Error Code | Power Fatal | Error | Bus | Device | Condition |
|---|---|---|---|---|---|
| 1 | Yes | Initial Power Fail | -- | +12V Run Dropout | Check +12V Run |
| 3 | Yes | +12V Run | -- | +12V Run Monitor | Check +12V Run Regulation |
| 6 | Maybe | S-Video Switch | RUN 1 | U16500 | IC or Supply Failure |
| 7 | Yes | Scan Loss | -- | Deflection | Loss of Scan |
| 9 | Yes | Video IC | RUN 1 | U22300 | IC or Supply Failure |
| 10 | Maybe | F2PIP POR | RUN 1 | U18100 | IC or Supply Failure |
| 11 | Maybe | Stereo Decoder | RUN 2 | U31701 | IC or Supply Failure |
| 12 | Maybe | AVR Latched | -- | | AVR Active |
| 13 | Yes | Fan Stopped | -- | U13101 | Fan or Fan Detect Circuit Failure |
| 16 | Yes | IIC Run1 or Run2 Bus Error | -- | U13101 | IIC clock or data failure |
| 17 | Never | USB Bus Latched | USB | U13201 | IC or Supply Failure |
| 18 | Yes | IIC Standby Bus | -- | U13101 | IIC clock or data failure |
| 20 | Yes | Software Stack Overflow | -- | U13101 | Various Conditions. Reset system. |
| 22 | Never | 4-Strikes -You're Out Occurred | -- | U13101 | Fault Detected by Micro |
| 24 | Never | Convergence Parity Error | -- | U19502 | EEPROM for Current Mode is Corrupted |
| 25 | Never | Convergence Loop Halted | -- | U19502 | Convergence Loop not Operating Properly |
| 26 | Always | Convergence Output Inactive | -- | U19502 | Convergence Output is Inactive |
| 44/45 | Maybe | F2PIP IC | RUN 1 | U18100 | IC or Supply Failure |
| 52/53/54/55 | Maybe | USB Hub IC | USB | U13201 | IC, Supply or USB downstream device failure |
| 64/65 | Maybe | PIP IF DAC | RUN 2 | U27902 | IC or Supply Failure |
| 66/67 | Maybe | Main Tuner DAC | RUN 1 | U32602 | IC or Supply Failure |
| 68 | Maybe | Deflection DAC | RUN 2 | U24800 | IC Failure |
| 72/73 | Maybe | SYNC Proc | RUN 2 | U38300 | IC or Supply Failure |
| 128/129 | Maybe | Stereo Decoder | RUN 1 | U31701 | IC or Supply Error |
| 134 | Maybe | Composite AV Switch | RUN 1 | U16501 | IC or Supply Failure |
| 136 | Maybe | NTSC Decoder | RUN 1 | U22300 | IC or Supply Failure |
| 136 | Maybe | TVB | RUN 2 | U11800 | IC or Supply Failure |
| 140 | Maybe | Deflection Processor | RUN 2 | U14350 | IC or Supply Failure |
| 160/161 | Maybe | I/O EEPROM | STDBY | U13102 | IC or Supply Failure |
| 164/167 | Maybe | Main Tuner EEPROM | RUN 1 | U32601 | IC or Supply Failure |
| 164/167 | Maybe | Deflection EEPROM | RUN 2 | U14354 | IC or Supply Failure |
| 168/169 | Maybe | 2nd Tuner EEPROM | RUN 2 | U27903 | IC or Supply Failure |
| 186/187 | Maybe | OSD IC | RUN 1 | U13202 | IC or Supply Failure |
| 192 | Maybe | PIP Tuner PLL | RUN 2 | U17401 | IC or Supply Failure |
| 194 | Maybe | PIP IF DAC | RUN 2 | U27902 | IC or Supply Failure |
| 196 | Maybe | Main Tuner PLL | RUN 1 | U25501 | IC or Supply Failure |
| 198 | Maybe | Main IF DAC | RUN 1 | U32602 | IC or Supply Failure |
| 220 | Maybe | System Micro | -- | U13101 | No Coummunications Between U13101 and U19502 |


T451
1
4
7
TP801
C450
10u
L454
180uH
Scan B+
CR713
C727
C456
470P
CR452
C453
9700P
Horz
Yoke
C454
.36uF
C463
1.54uF
C457
.22uF
TP301
T300
1
4
3
6
Horz
Drive
Pulse
from
U14350-20
Q451
H.O.T.
R304
10
TP602
TP803
+12Vr
Q455
Q454
D
G
S
Q456
S-Cap Switching
from Deflection
CR455
5.1V
+12Vr
Q457

1H - 70VDC
2H - 136VDC
2.14H - 141VDC
2.4H - 160VDC

0VDC - 1H
5VDC - 2H
12VDC - 2.14/2.4H

S-Cap Configuration

| Scan Rate | S-Caps |
|---|---|
| 1H | C454/C463/C457 |
| 2H | C454/C457 |
| 2.X | C454/C463 |

Horizontal Deflection & S-Cap Switching

## Horizontal Deflection

Scan B+ can vary from 70Vdc to 160Vdc based on what scan rate is needed. Scan B+ is the current source for Q451 and the horizontal yoke. As Q451 (H.O.T.) starts to turn on C454 (S-cap) discharges through the yoke moving the beam from center of the screen towards the right side of the screen. At the start of retrace, Q451 turns off and C453 (retrace cap) begins to charge from the energy stored in the yoke moving the beam back to center. With C453 charged and no energy left in the yoke, C453 discharges back through the yoke moving the beam from center to the left side of the screen. With the beam at the left side of the screen, CR452 is forward biased and starts to conduct moving the beam from left to center. Q456, Q457, Q454 and Q455 are switches that add or remove capacitance as needed for each of the horizontal deflection modes. C454, C463 and C457 are for 1H, C454 and C457 are for 2H with C454 and C463 used for 2.14H and 2.4H.

## Horizontal Deflection

Scan B+ can vary from 70Vdc to 160Vdc based on what scan rate is needed. Scan B+ is the current source for Q451 and the horizontal yoke. As Q451 (H.O.T.) starts to turn on, see figure 1 (Timing 1), C454 (S-cap) discharges through the yoke moving the beam from center of the screen towards the right side of the screen. At the start of retrace, Q451 turns off and C453 (retrace cap) begins to charge from the energy stored in the yoke moving the beam back to center, see figure 2 (Timing 2). With C453 charged and no energy left in the yoke, C453 discharges back through the yoke moving the beam from center to the left side of the screen, see figure 3 (Timing 3). With the beam at the left side of the screen, CR452 is forward biased and starts to conduct moving the beam from left to center, see figure 4 (Timing 4).

***Note: Figure numbers correspond to timing numbers on next page.***

Trace Center to Right (Right Half)

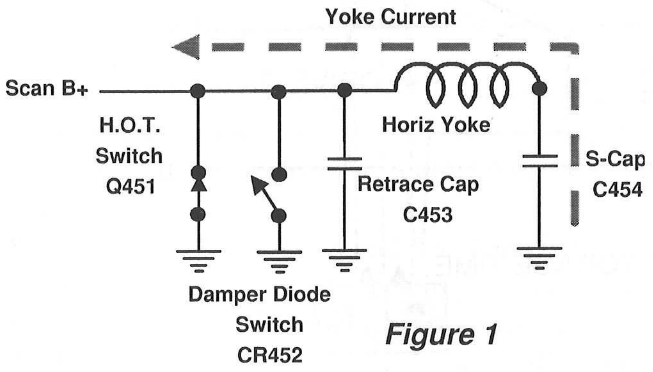

Yoke Current
Scan B+
H.O.T.
Switch
Q451
Horiz Yoke
S-Cap
C454
Retrace Cap
C453
Damper Diode
Switch
CR452

*Figure 1*

Retrace Right to Center

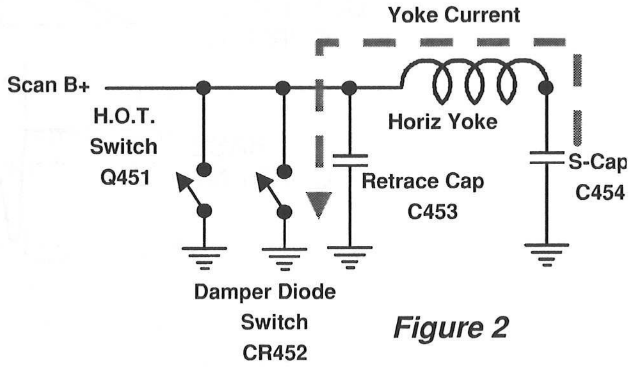

Yoke Current
Scan B+
H.O.T.
Switch
Q451
Horiz Yoke
Retrace Cap
C453
S-Cap
C454
Damper Diode
Switch
CR452

*Figure 2*

Retrace Center to Left

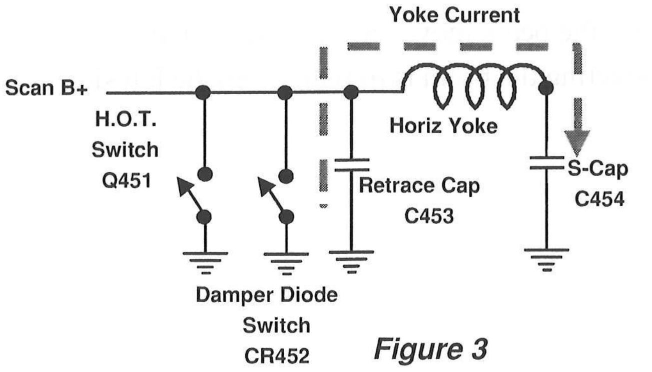

Yoke Current
Scan B+
H.O.T.
Switch
Q451
Horiz Yoke
S-Cap
C454
Retrace Cap
C453
Damper Diode
Switch
CR452

*Figure 3*

Trace Left to Center (Left Half)

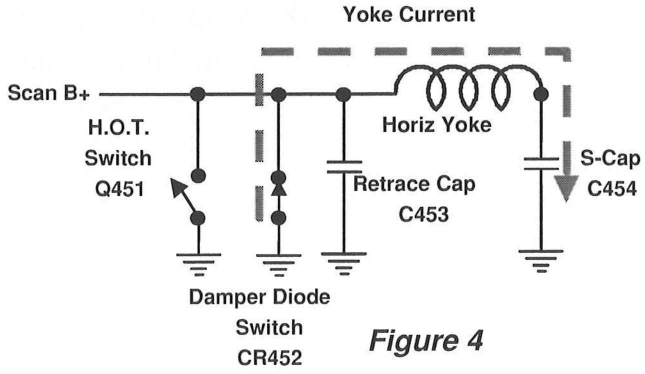
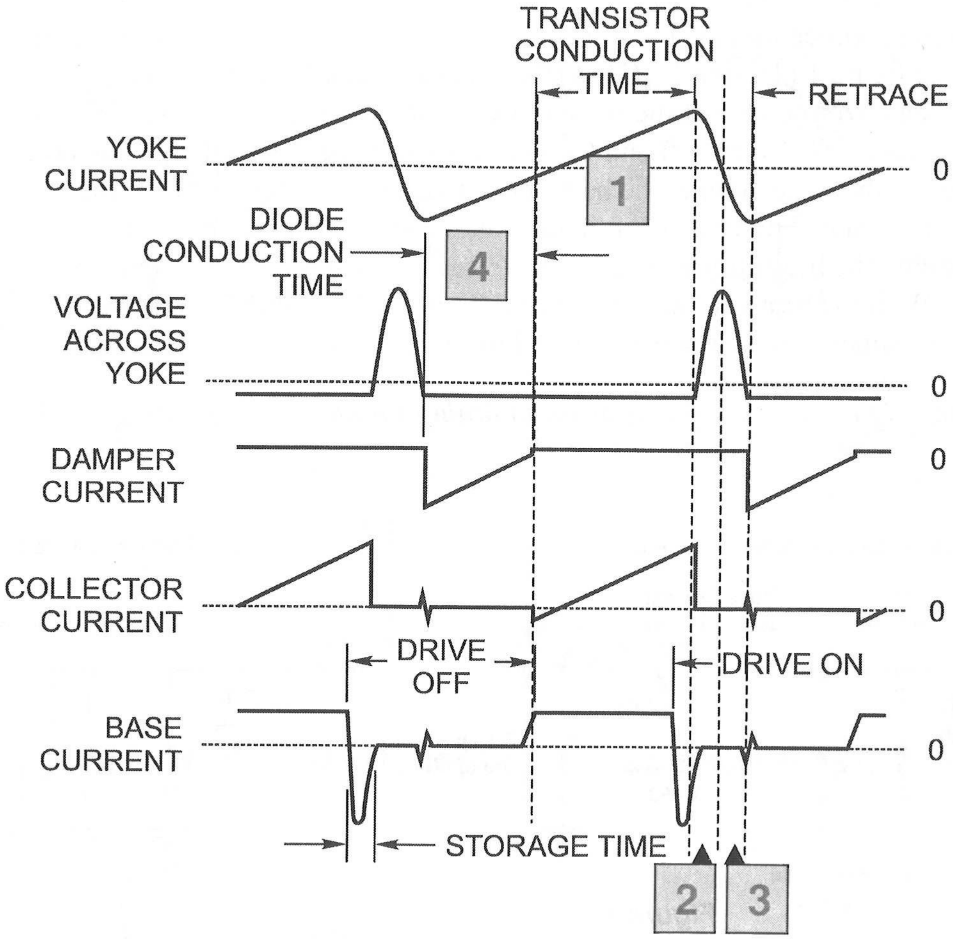

Yoke Current
Scan B+
H.O.T.
Switch
Q451
Horiz Yoke
S-Cap
C454
Retrace Cap
C453
Damper Diode
Switch
CR452

*Figure 4*

**Note: Switch closed indicates device is conducting.**

## Horizontal Deflection Timing Chart


TRANSISTOR CONDUCTION TIME
RETRACE
YOKE CURRENT
0
1
DIODE CONDUCTION TIME
4
VOLTAGE ACROSS YOKE
0
DAMPER CURRENT
0
COLLECTOR CURRENT
0
DRIVE OFF
DRIVE ON
BASE CURRENT
0
STORAGE TIME
2
3

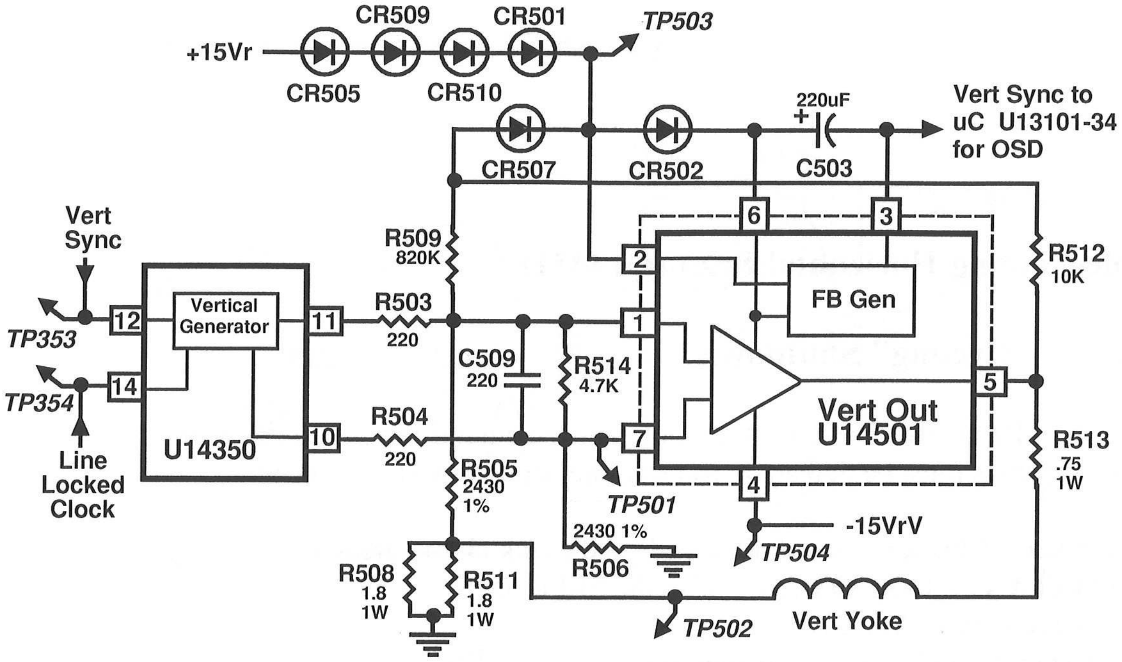
1. During transistor conduction time the beam is moving from center of it's trace to the right side.
2. During first half of retrace the beam moves first from right to center.
3. During the second half of retrace the beam moves from center to left.
4. When the damper diode is conducting the beam is moving from the left side of its trace to the center.

## Troubleshooting Horizontal Scan (Q14451)

### *Symptom:* "Cycling" Shutdown

**NOTE:** In order to effectively troubleshoot the horizontal drive circuit, the scan loss detect circuits must be defeated. Refer to the Scan Loss Detect section.

1. Obtain latest Chipper Check failure code and check circuit areas accordingly. **IMPORTANT: DO NOT** reinitialize the EEPROM!
2. Remove & secure CRT CBA.
3. Check standby and main power supplies.
4. Check for horizontal drive at TP14301 (connect scope across primary of T14300).
5. Check base drive of Q14451 (should be very similar to TP14301).
6. Check collector waveform of Q14451 (amplitude & shape are critical).
7. If there is NO collector waveform present, check Q14451 and Scan B+ generator circuits.
8. If waveform is present and it's shape is correct but is approximately ½ amplitude, check for an open in yoke and yoke return circuitry.
9. If waveform is low and distorted (ringing), unplug horizontal yoke.
10. If waveform is still distorted, check all components in Q14451 collector circuit.


+15Vr
CR509
CR501
TP503
CR505
CR510
CR507
CR502
220uF
C503
Vert Sync to uC U13101-34 for OSD
Vert Sync
TP353
TP354
Line Locked Clock
Vertical Generator
U14350
12
14
11
10
R509
820K
R503
220
R504
220
C509
220
R514
4.7K
R505
2430
1%
TP501
2430 1%
R506
R508
1.8
1W
R511
1.8
1W
FB Gen
Vert Out
U14501
1
2
3
4
5
6
7
-15VrV
TP504
TP502
Vert Yoke
R512
10K
R513
.75
1W

Vertical Deflection Block Diagram

## Vertical Deflection Overview

The vertical drive is generated by the deflection generator U14350 and applied directly to the vertical output U14501. Vertical yoke current in one direction first drives the beam from the top to the center while current in the other direction drives the beam from the center to the bottom of the screen. U14501 supplies all vertical deflection yoke current. The amount of current determines how far the beam is deflected. Deflection is accomplished by pulling current through the deflection yoke, creating an electromagnetic field around the yoke winding and pushing the electron beam away from center as yoke current builds, or allow it to move back to the center of the screen as yoke current decreases. During scan, current must flow in the yoke in such a direction to cause the beam to travel down the face of the CRT. During retrace, the yoke must return it to the top of the screen to start the next trace.

During retrace a higher voltage needs to be applied to the yoke so the beam will return to the top much quicker than it scanned down. The vertical circuit uses a double ended supply (neg & pos). However, because retrace must occur in such a short time compared to trace, a higher positive supply is needed by U14501. During trace, the negative lead of C503 (pin 3) is connected internally to the -15V supply inside U14501. With the positive lead of C503 connected to the +15V supply, there is approximately 25 volts across the C503. During trace, the capacitor charges to about 30 volts from the negative supply to the positive supply. At retrace, the switch inside U14501 connects pin 3 to pin 2 applying the +15V supply to the negative side of C503. CR502 now blocks current flow between C503 & the +15V supply. The charge stored on C503 and the +15V supply on the negative terminal produce about +40 volts to pin 6, which now begins to supply output current for the yoke. The increased supply voltage quickly retraces the beam to the top of the screen.

## Troubleshooting Vertical (U14501)

### *Symptom:* No Vertical Scan

1. Obtain latest Chipper Check failure code and check circuit areas accordingly. **IMPORTANT: DO NOT** reinitialize the EEPROM!
2. Remove & secure CRT CBA.
3. Disconnect vertical yoke.
4. Check vertical supplies (+12VDC & -15VDC).
5. Check for waveform at U501-5.
6. If DC voltage is Hi & no waveform at U501-5, check the DC voltage and waveform on U501-1 & 7.
7. If the DC voltage & waveform on U501-1 & 7 is not correct (.8VDC), check R505, R506 and Deflection SIP module.
8. If the DC voltage is correct but no waveform, suspect Deflection SIP module.
9. If the DC voltage & waveform on U501-1 & 7 is correct, suspect U501.

## MM/MMC/DTV Input/Output CBA Service Position

**Purpose:**

This GSI (General Information Series) provides the service technician with a convenient method for placing the new multimedia monitors in a functional service position. This GIS covers the service position of both the Main CBA and the I/O circuit board. The I/O circuit board service position allows the technician complete access to the back side of the I/O CBA for both measurements and parts replacement.

**Main CBA Procedure:**

1. Remove back cover.
2. Release all cable ties.
3. Release snap locks on left and right chassis guide rails.
4. Pull chassis to rear and tilt up carefully avoiding damage to pix tube and CRT CBA.
5. Remove three (3) screws securing bottom cover and release six (6) snap locks.

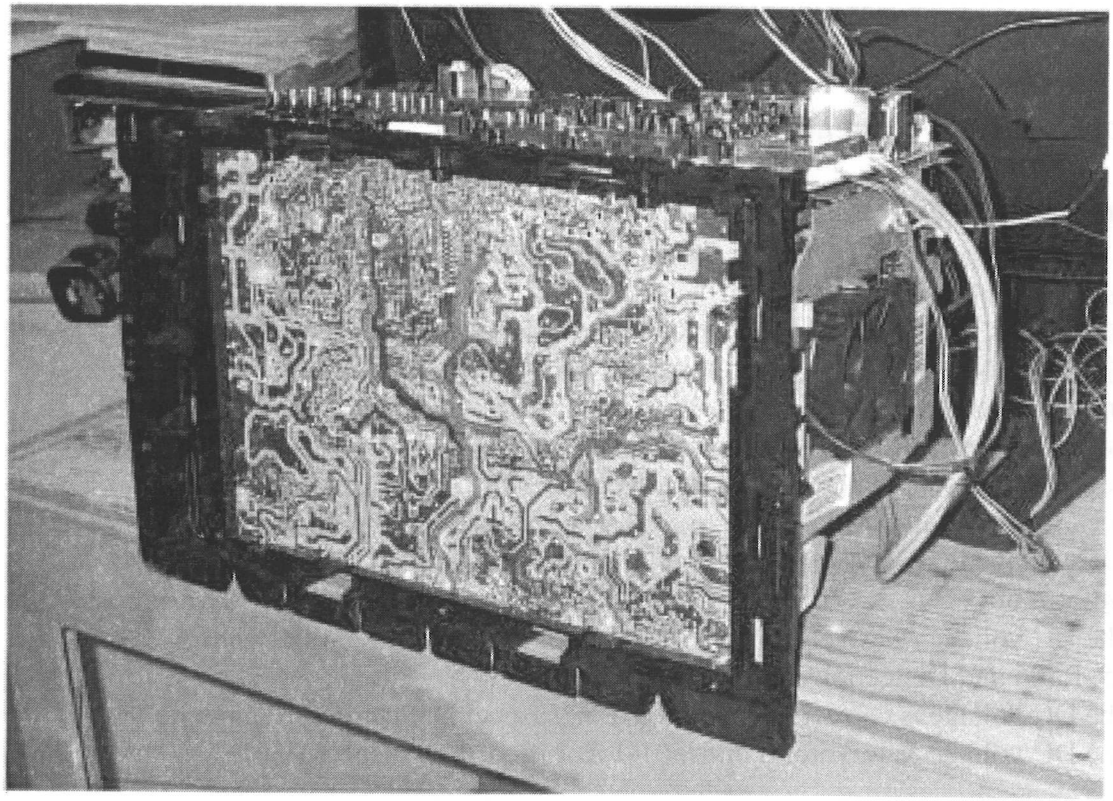


Fig. 1; Main Circuit Board Service Position

## I/O CBA Procedure:

**NOTE:** Before beginning, release all Input/Output cables from their retainers. The Main tuner, all cooling fans and all communication cables must be connected or set will shut down. The PIP (2nd tuner) can be disconnected.

**Step 1:** Release I/O circuit board (9 twist tabs, see closeup Fig. 3).
**Step 2:** Release or unplug PIP tuner (does not have to be connected).
**Step 3:** Release Main tuner (must remain connected).
**Step 4:** Remove top cooling fan (closeup Fig. 4) from bracket and place in outboard position (Fig. 2).
**Step 5:** Rotate side cooling fan to gain cable length (if needed).
**Step 6:** Reroute cable (P14276) from over the top to under the I/O CBA mounting plate (Fig. 2).

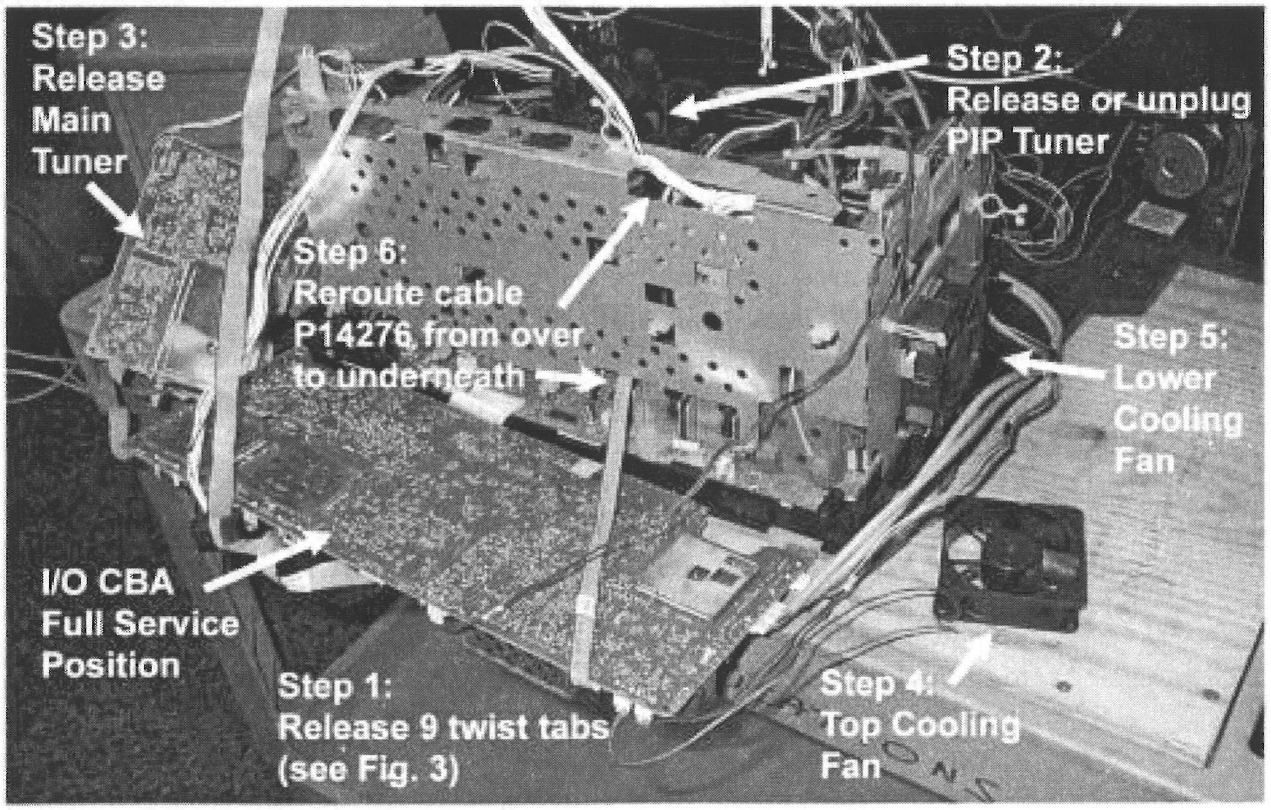

Step 3: Release Main Tuner
Step 2: Release or unplug PIP Tuner
Step 6: Reroute cable P14276 from over to underneath
Step 5: Lower Cooling Fan
I/O CBA Full Service Position
Step 1: Release 9 twist tabs (see Fig. 3)
Step 4: Top Cooling Fan

Fig. 2; Input/Output Circuit Board Service Position

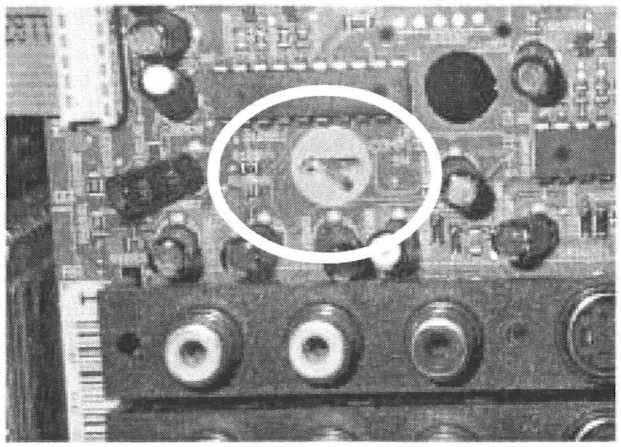


Fig. 3; Twist Lock Tab Closeup

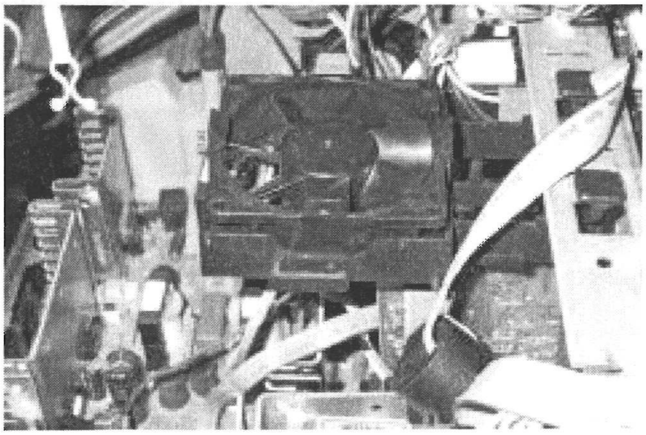


Fig. 4; Top Cooling Fan Closeup

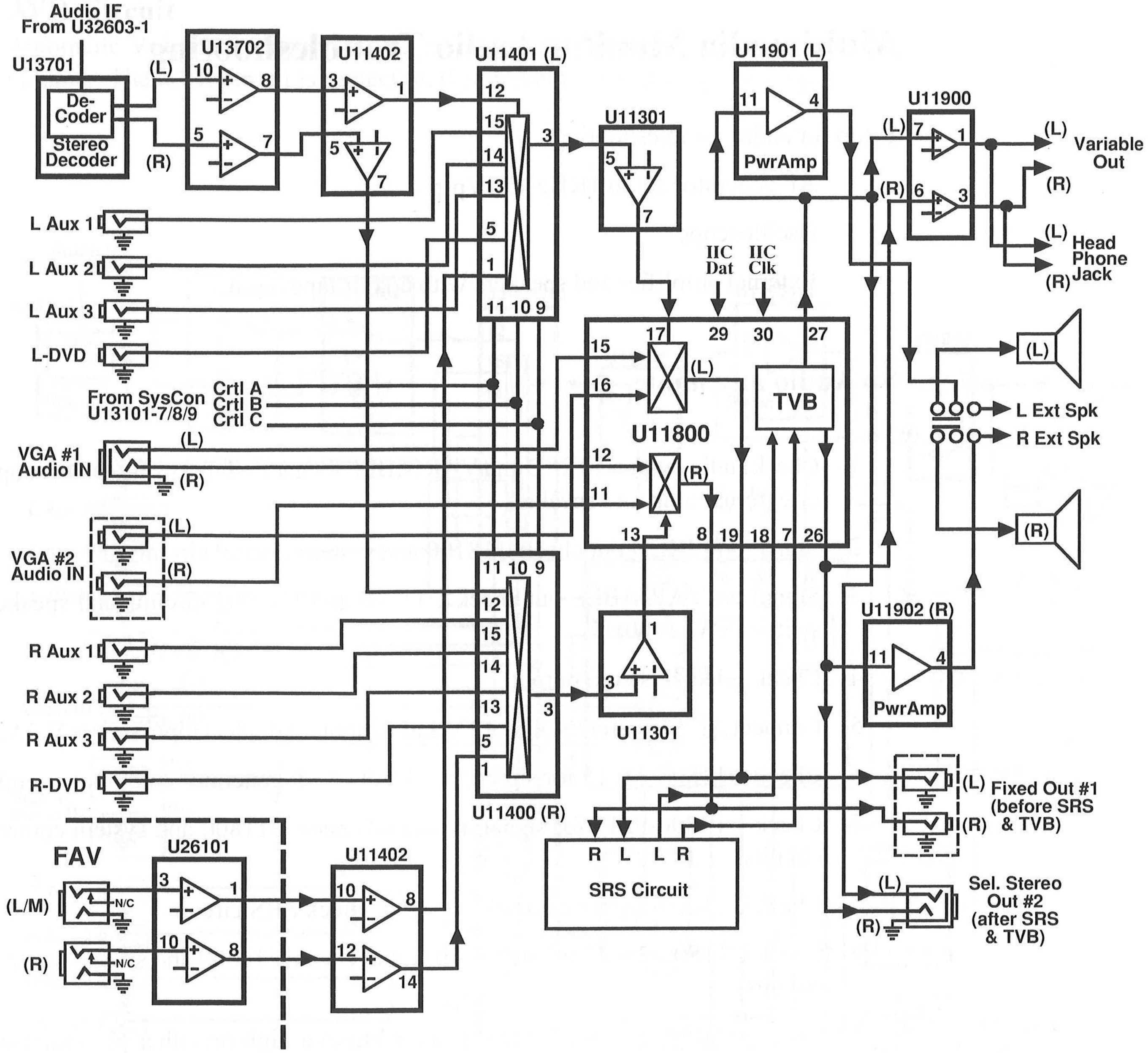
## Audio Switching & Processing Overview

The audio input capabilities of the Multimedia Monitor include the normal NTSC off-air audio, three different Auxiliary inputs, a left & right DVD (YUV or Y, Pr, Pb) audio input, separate VGA#1 & VGA#2 audio inputs along with a convenient front panel audio input jack. The audio outputs include a Fixed (before SRS & TVB) & Variable (after SRS & TVB) volume controlled. External speaker outputs are also provided along with capabilities to disconnect the internal speakers.

The audio processing and switching circuits contain two major processing IC's along with various switching and amplification integrated circuits. As shown in the upper left of the Figure 1, IC U13701 contains the Stereo/SAP decoders while all signal routing and switching is performed by discreet switching IC's, U11400 (R) and U11401 (L). These input switching IC's are controlled by the main microprocessor, U13101, via three individual control lines.

The tone, volume and balance (TVB) processing is performed within IC U11800 and controlled by the System Control Microcomputer U13101 via the IIC bus. The TVB IC also contains switching output lines controlled over the IIC bus and used to control the input switching IC's. Switch IC's U11400 and U11401 are responsible for routing and switching the auxiliary, DVD audio signal and the front panel audio input signals. U11400 handles the Right while U11401 handles the Left audio signals. Selection of VGA#1 and VGA#2 audio signals is handled internally by the TVB IC, U11800.

Selected audio (Fixed) exits the TVB IC at pins 8 & 19. The signals are applied to the SRS circuit for processing or input directly back to the TVB IC at pin 7 & 18. The external Variable output connections are made here. After re-entering the IC at pins 7 & 18 Tone, Volume and Balance are added to the signals. The audio is then applied to the power amplifiers U11901 & U11902. The audio from pins 26 and 27 is also applied to an amplifier (U11900) which provides the HiFi (variable level) output and provides signal to the front panel headphone jack. At this point one more connection is made to a stereo output jack mounted on the rear jack panel. This provides a variable line level output for connection to an amplified speaker system. The speaker switch selects between the internal speakers and the external speaker outputs.


Audio IF
From U32603-1
U13701
De-Coder
Stereo Decoder
(L)
(R)
U13702
U11402
U11401 (L)
U11301
U11901 (L)
PwrAmp
U11900
Variable Out
Head Phone Jack
L Aux 1
L Aux 2
L Aux 3
L-DVD
From SysCon U13101-7/8/9
Crtl A
Crtl B
Crtl C
IIC Dat
IIC Clk
U11800
TVB
L Ext Spk
R Ext Spk
VGA #1 Audio IN
VGA #2 Audio IN
R Aux 1
R Aux 2
R Aux 3
R-DVD
U11902 (R)
U11400 (R)
Fixed Out #1 (before SRS & TVB)
FAV
U26101
(L/M)
N/C
SRS Circuit
Sel. Stereo Out #2 (after SRS & TVB)

**AudioSwitching/Processing Block Diagram**

Figure 1, Audio Switching/Processing Block Diagram

# Multimedia Monitor Audio Troubleshooting

Setup for audio troubleshooting:

- AF generator set to 1KHz @ 1Vp-p
- Oscilloscope
- External amplifier and speakers with aux or tape input.

## No Audio any mode

1. Check audio outputs FIXED and VARIABLE for audio signal using oscilloscope or external amp and speakers.
2. Signal on FIXED out check U18100 and system control circuits.
3. Signal on VARIABLE out check U11900 and U11902 circuits and speaker switch (SW11900)
4. Check selected stereo output.
5. Connect AF generator to Digital TV audio inputs and select input source VGA2.
6. Check U11800-11, 15 for signal, no signal check generator and input circuit.
7. Check U11800-9, 19 for signal, no signal check U11800 and system control circuits.
8. Check U11800-7, 18 for signal, no signal check SRS circuit.
9. Check U11800-26, 27 for signal, no signal check U11800 and system control circuits.
10. Check U11800-3, 8 for 0Vdc (Speaker Mute) a high on either pin indicates speakers are muted.
11. Check mute circuits and system control.

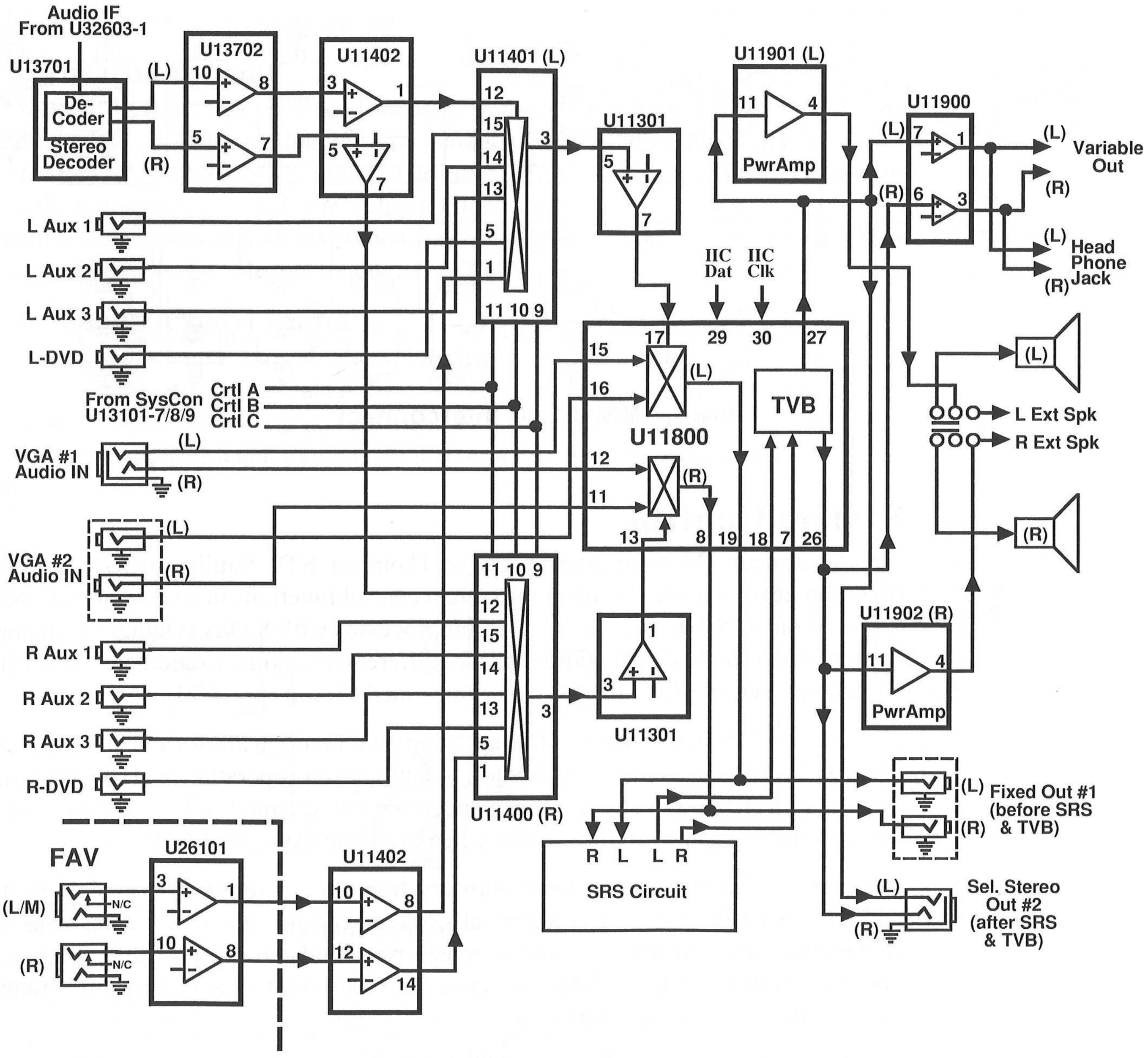
**NOTE:** To bypass SRS circuit, connect U11800 pin 9 to pin 7, pin 19 to pin 18.

**Tip:** Max volume output from U11800 TVB is 900mv P-P, an AF signal can be injected at U11800-26, 27 provided the signal level does not exceed 900mv P-P or damage to the output will occur.

**Tip 2:** A problem in the AVR circuit can result in a reduction of volume.

## AVR Circuit

Automatic Volume Reduction circuit is only active when volume is at or near max volume. The AVR circuit is protection that prevents over driving the outputs.


Audio IF
From U32603-1
U13701
De-Coder
Stereo Decoder
(L)
(R)
U13702
U11402
U11401 (L)
U11901 (L)
PwrAmp
U11301
U11900
(L) Variable Out
(R)
(L) Head Phone Jack
(R)
L Aux 1
L Aux 2
L Aux 3
L-DVD
IIC Dat
IIC Clk
From SysCon U13101-7/8/9
Crtl A
Crtl B
Crtl C
VGA #1 Audio IN
(L)
(R)
U11800
TVB
L Ext Spk
R Ext Spk
VGA #2 Audio IN
(L)
(R)
U11902 (R)
PwrAmp
R Aux 1
R Aux 2
R Aux 3
R-DVD
U11400 (R)
U11301
(L) Fixed Out #1 (before SRS & TVB)
(R)
FAV
U26101
U11402
(L/M)
(R)
N/C
SRS Circuit
R L L R
(L) Sel. Stereo Out #2 (after SRS & TVB)
(R)

AudioSwitching/Processing Block Diagram

Figure 2, Audio Switching/Processing Block Diagram

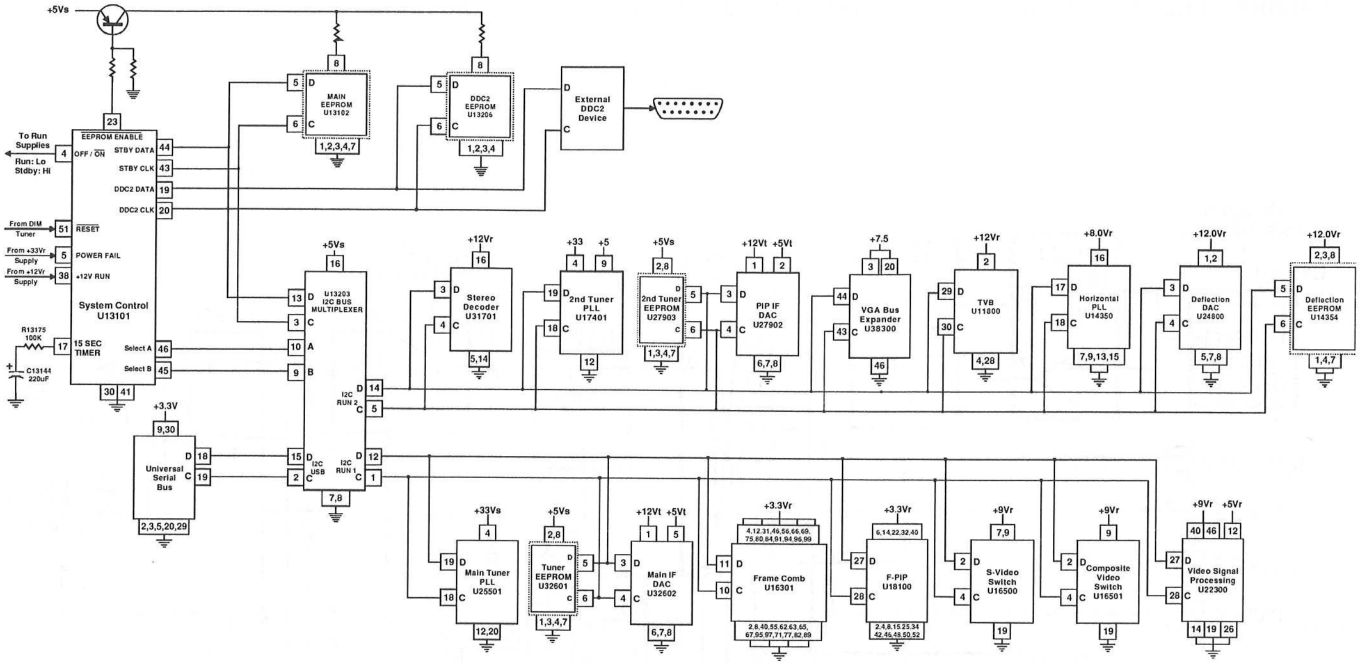

+5Vs
23
EEPROM ENABLE
To Run Supplies
Run: Lo
Stdby: Hi
4
OFF / ON
STBY DATA 44
STBY CLK 43
DDC2 DATA 19
DDC2 CLK 20
From DIM Tuner
51 RESET
From +33Vr Supply
5 POWER FAIL
From +12Vr Supply
38 +12V RUN
System Control
U13101
R13175
100K
17 15 SEC TIMER
C13144
220uF
Select A 46
Select B 45
30 41
MAIN EEPROM U13102
8
5 D
6 C
1,2,3,4,7
DDC2 EEPROM U13206
1,2,3,4
External DDC2 Device
D
C
+5Vs
16
U13203
I2C BUS MULTIPLEXER
13 D
3 C
10 A
9 B
I2C RUN 2
D 14
C 5
15 D
2 C
I2C USB
I2C RUN 1
D 12
C 1
7,8
+3.3V
9,30
Universal Serial Bus
D 18
C 19
2,3,5,20,29
+12Vr
Stereo Decoder U31701
3 D
4 C
5,14
+33
+5
2nd Tuner PLL U17401
19 D
18 C
12
2nd Tuner EEPROM U27903
2,8
1,3,4,7
+12Vt
+5Vt
PIP IF DAC U27902
6,7,8
+7.5
VGA Bus Expander U38300
44 D
43 C
46
+12Vr
TVB U11800
29 D
30 C
4,28
+8.0Vr
Horizontal PLL U14350
17 D
18 C
7,9,13,15
+12.0Vr
Deflection DAC U24800
1,2
5,7,8
+12.0Vr
Deflection EEPROM U14354
2,3,8
1,4,7
+33Vs
Main Tuner PLL U25501
12,20
+5Vs
Tuner EEPROM U32601
+12Vt
+5Vt
Main IF DAC U32602
+3.3Vr
4,12,31,46,56,66,69,
75,80,84,91,94,96,99
Frame Comb U16301
11 D
10 C
2,8,40,55,62,63,65,
67,95,97,71,77,82,89
+3.3Vr
6,14,22,32,40
F-PIP U18100
27 D
28 C
2,4,8,15,25,34
42,46,48,50,52
+9Vr
7,9
S-Video Switch U16500
2 D
4 C
19
+9Vr
9
Composite Video Switch U16501
+9Vr
+5Vr
40 46 12
Video Signal Processing U22300
14 19 26

Figure 3, MM101 IIC Interconnect

# System Control

The Multimedia Monitor uses a single Thomson ST9 family micro controller (microprocessor) specially suited for system control functions in a television chassis. It is a 56 pin SDIP package using a 16 bit processor with 8 D/A (Digital to Analog) converter ports individually addressable for different functions. Communications with connected devices utilize the IIC (*I*nter *I*ntegrated *C*ircuit) protocol.

An integrated OSD (On-Screen Display) peripheral function allows a display of up to 15 lines, 34 characters long, using 8 colors, 4 font sizes and operation in 1H or 2H (twice Horizontal Scan) mode for a sharp appearance during all scan modes. The microprocessor decodes closed captioned information when available using the OSD to display it.

Programming information is stored outboard from the microprocessor in a 4KiloBit (512Kbyte) EEPROM that contains all system control functions, some chassis alignments, status registers to store customer settings and current operating conditions. There are three other EEPROM's associated with different chassis functions. Some contain other chassis alignments.

The System Control microprocessor IC, U13202, is responsible for monitoring and controlling virtually all functions of the chassis. U13202 receives all operator inputs from the front panel keyboard or the remote control hand unit and interprets them for the control of different chassis functions. System control also generates channel tuning data, picture control (tint, color, etc.)

signals and provides the “Power On” command. The microprocessor is always "alive" unless the AC is disconnected or the set is placed in "serviceman" (requiring Chipper Check™ control) mode.

There are at least 15 individual devices directly controlled by the main IIC bus. To alleviate loading, the main bus is split into three bus lines. Two are connected to various chassis components, one drives the USB downstream control device. The use of separate buses accommodate IC's on Standby or Run supplies and also accommodate IC's that use common bus addresses.

## Keyboard Scanning

Figure 4 illustrates the keyboard scanning inputs and outputs. Keyboard scanning consists of one Key Scan output (KD1) and three Key Scan inputs (KS1, KS2, KS3) lines on system control IC, U13101. The input ports (KS1-3) are scanned continuously by the microprocessor and when a high or low is detected at the input, system control begins pulsing the output lines. When the proper output signal has been decoded by the microprocessor, the selected function is performed.

## IR Remote Control Input

Infrared remote control signals are captured and amplified by IR13401 and appear at pin 3 as 5 volt negative going data pulses. When no IR is received, the DC level at pin 3 is about 5 volts. IR13401 is powered by the +5 volt standby supply in most models. In others, the +12 volt standby supply, limited by a 5.1 volt zener diode, CR13401 powers the device.

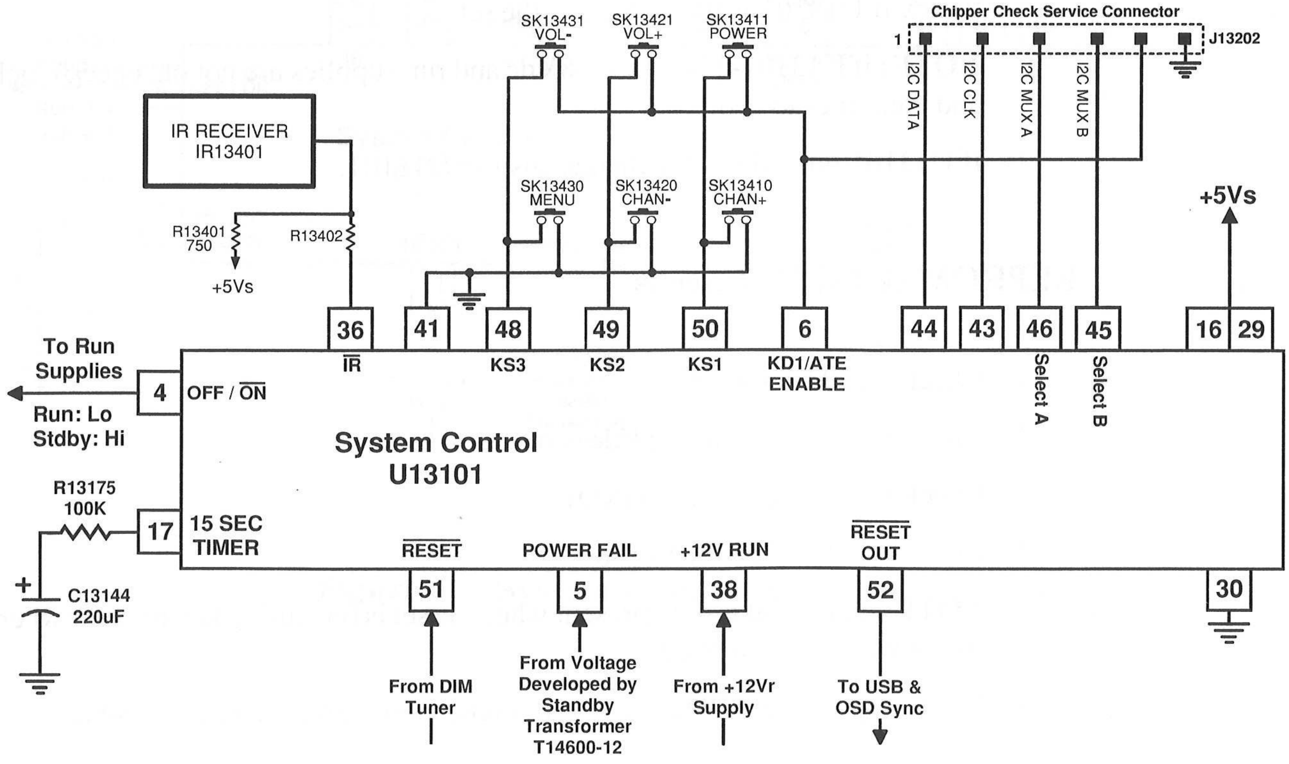

Chipper Check Service Connector
1
J13202
I2C DATA
I2C CLK
I2C MUX A
I2C MUX B
SK13431 VOL-
SK13421 VOL+
SK13411 POWER
SK13430 MENU
SK13420 CHAN-
SK13410 CHAN+
IR RECEIVER IR13401
R13401 750
R13402
+5Vs
+5Vs
36
41
48
49
50
6
44
43
46
45
16
29
IR
KS3
KS2
KS1
KD1/ATE ENABLE
Select A
Select B
To Run Supplies
Run: Lo
Stdby: Hi
4
OFF / ON
System Control U13101
R13175 100K
17
15 SEC TIMER
C13144 220uF
+
RESET
POWER FAIL
+12V RUN
RESET OUT
51
5
38
52
30
From DIM Tuner
From Voltage Developed by Standby Transformer T14600-12
From +12Vr Supply
To USB & OSD Sync

Figure 4, System Control Keyboard Control

# Multimedia Monitor Syscon Troubleshooting

## Dead set wont turn on.

1. Check standby supplies
2. Check U13101-30, 41 (GNDs)
3. Check U13101-51 (Reset) for +5Vdc
4. If Reset voltage is missing check reset circuit
5. Check key scan inputs to U13101 (pins 48, 49, 50) for +5Vdc and 2.5Vdc pin 6.
6. If voltages low or missing check FPA circuit
7. Check for oscillator on pins 40 and 42 of U13101 (2.5Vdc and 5VP-P oscillator) 8MHz.

   **NOTE:** Use frequency counter to measure frequency.
8. If signal low or off frequency check oscillator circuit.
9. Monitor U13101-4 and push the power switch. Voltage should go from high to low if U13101 is trying to start the set.

   **NOTE:** if U13101-4 is about .68Vdc and run supplies are not on, check clock and data lines to eeprom.
10. If U13101 pin 4 does not change suspect U13101.

## EEPROM (U13201) Checks

1. Check U1302-8 for +5Vdc
2. Check U13102-5, 6 for +5Vdc
3. Check U13102-2, 3, 4, 7 (GND)
4. Check U13102-5, 6 for 5Vp-p

   **NOTE:** this signal is only present when the set is on, during key press or when AC power is first applied.
5. Use Chipper Check™ to see if communication with eeprom is possible.

# Static Check of System Control Circuit.

| Device and pin numbers | OHMS reading to GND |
|---|---|
| U13101-48, 49, 50 | 197K |
| U13101-6 | 30K |
| U13101-43, 44 | 10.4K |
| U13102-5, 6 | 11.5K |
| U13203-2, 5, 14, 15 | .2M |
| U13203-1, 12 | 100K |

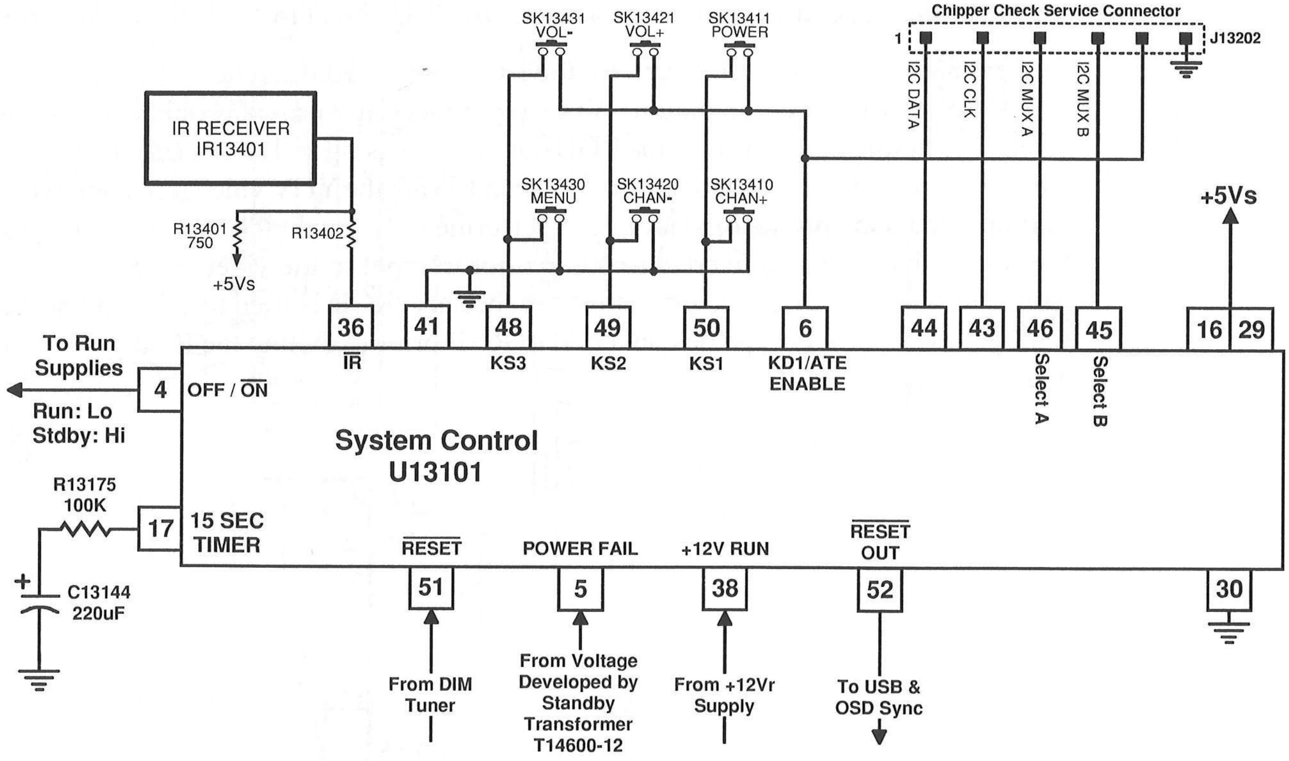

SK13431 VOL-
SK13421 VOL+
SK13411 POWER
Chipper Check Service Connector
1
J13202
I2C DATA
I2C CLK
I2C MUX A
I2C MUX B
IR RECEIVER IR13401
SK13430 MENU
SK13420 CHAN-
SK13410 CHAN+
+5Vs
R13401 750
R13402
+5Vs
36
41
48
49
50
6
44
43
46
45
16
29
IR
KS3
KS2
KS1
KD1/ATE ENABLE
Select A
Select B
To Run Supplies
Run: Lo
Stdby: Hi
4
OFF / ON
System Control U13101
R13175 100K
17
15 SEC TIMER
C13144 220uF
RESET
POWER FAIL
+12V RUN
RESET OUT
51
5
38
52
30
From DIM Tuner
From Voltage Developed by Standby Transformer T14600-12
From +12Vr Supply
To USB & OSD Sync

Figure 5, System Control Keyboard Control

## Video Processing Overview

The video processing and switching section of the Multimedia Monitor (see Figure 6) is composed of a Video Processor IC, U22300, F2PIP IC, U18100 (described previously), and five (5) video switching IC's. Video input switching and video processing in the MM101 chassis is slightly different from previous chassis in that it does not incorporate the familiar T-Chip. The deflection functions which were previously handled by the T-Chip are performed separately in a deflection processor IC, U14350. However, all video processing, AKB operation, color, tint, brightness and contrast still occurs within the video processor IC U22300. Signal switching remains much the same as in earlier chassis although at first glance may appear more complex because of the greater number and variety of inputs.

All internal video processing is done in YUV format and converted to RGB for output to the CRT drivers. All composite inputs (baseband video) are separated into Y/C by the F2PIP IC. The video processor converts the Y/C signal to YUV for further use.

There is a separate processing path for the RGB inputs. RGB comes in on pins 33, 34 and 35 for VGA "Text" operation. VGA text processing provides only contrast and brightness before application to the RGB output processing and AKB section of the IC. No color processing is available. Pins 51, 52 and 53 are the YUV video input pins where normal luma and chroma operations are performed. Normal video signals, no matter the source, have been converted to YUV prior to input to the video processor. This simplifies the switching circuits. However, because RGB is used to drive the picture tube, all YUV signals must be converted to RGB prior to exiting the IC at pins 41, 42 and 43.

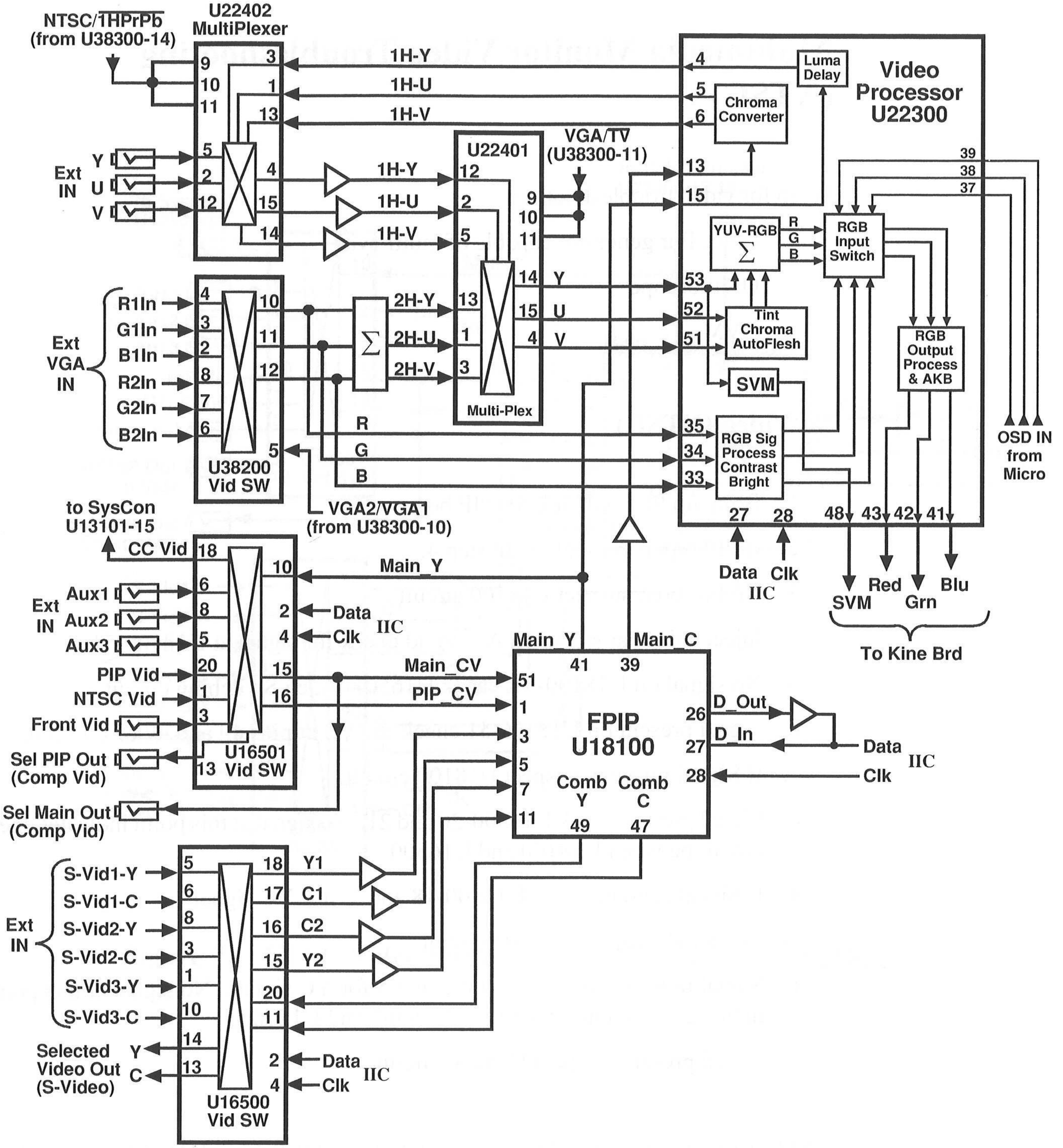

NTSC/1HPrPb
(from U38300-14)
U22402
MultiPlexer
9
10
11
3
1
13
5
2
12
4
15
14
Ext
IN
Y
U
V
1H-Y
1H-U
1H-V
1H-Y
1H-U
1H-V
U22401
12
2
5
9
10
11
13
1
3
14
15
4
Y
U
V
Multi-Plex
VGA/TV
(U38300-11)
Video
Processor
U22300
Luma
Delay
Chroma
Converter
4
5
6
13
15
39
38
37
YUV-RGB
Σ
R
G
B
RGB
Input
Switch
53
52
51
Tint
Chroma
AutoFlesh
SVM
RGB
Output
Process
& AKB
35
34
33
RGB Sig
Process
Contrast
Bright
27
28
48
43
42
41
OSD IN
from
Micro
Data
Clk
IIC
SVM
Red
Grn
Blu
To Kine Brd
Ext
VGA
IN
R1In
G1In
B1In
R2In
G2In
B2In
4
3
2
8
7
6
10
11
12
5
U38200
Vid SW
2H-Y
2H-U
2H-V
Σ
R
G
B
VGA2/VGA1
(from U38300-10)
to SysCon
U13101-15
CC Vid
18
10
Main_Y
Ext
IN
Aux1
Aux2
Aux3
PIP Vid
NTSC Vid
Front Vid
Sel PIP Out
(Comp Vid)
Sel Main Out
(Comp Vid)
6
8
5
20
1
3
13
2
4
15
16
Data
Clk
IIC
U16501
Vid SW
Main_CV
PIP_CV
Main_Y
Main_C
41
39
51
1
3
5
7
11
FPIP
U18100
Comb
Y
Comb
C
49
47
26
27
28
D_Out
D_In
Data
Clk
IIC
Ext
IN
S-Vid1-Y
S-Vid1-C
S-Vid2-Y
S-Vid2-C
S-Vid3-Y
S-Vid3-C
5
6
8
3
1
10
14
13
18
17
16
15
20
11
2
4
Y1
C1
C2
Y2
Data
Clk
IIC
Selected
Video Out
(S-Video)
Y
C
U16500
Vid SW

Figure 6, Video Switching and Processing Circuits

# Multimedia Monitor Video Troubleshooting (NTSC)

Setup for video troubleshooting:

- Color Bar generator capable of multi-sync
- Oscilloscope
- DVM

## No Video (NTSC)

1. Bring up PIP and look for PIP box.
2. If PIP box is present, go to step 4.
3. No PIP box, suspect U18100 circuit.
4. Inject color bar signal on Aux1 and check for signal at U18100-51.
5. No signal on U18100-51, check U16501 Video Switching circuit.
6. Signal present on U18100-51 check for YC at pins 49 and 47 of U18100.
7. If Signal missing, suspect U18100 circuit.
8. Signal present check U16500-20 and 21. No signal at this point indicates open circuit between U18100 and U16500.
9. If Signal present check U16500-18 and 17 for YC signal.
10. No signal, suspect U16500 circuit
11. Signal present, check U18100-3 and 5 for YC signal. No signal at this point indicates open circuit between U16500 and U18100.
12. Signal present, suspect U18100 circuit.

**NOTE:** Video from any S-Video mode will indicate U18100 and U16500 are working. Be sure to check *all* inputs for signal to help eliminate working circuits.

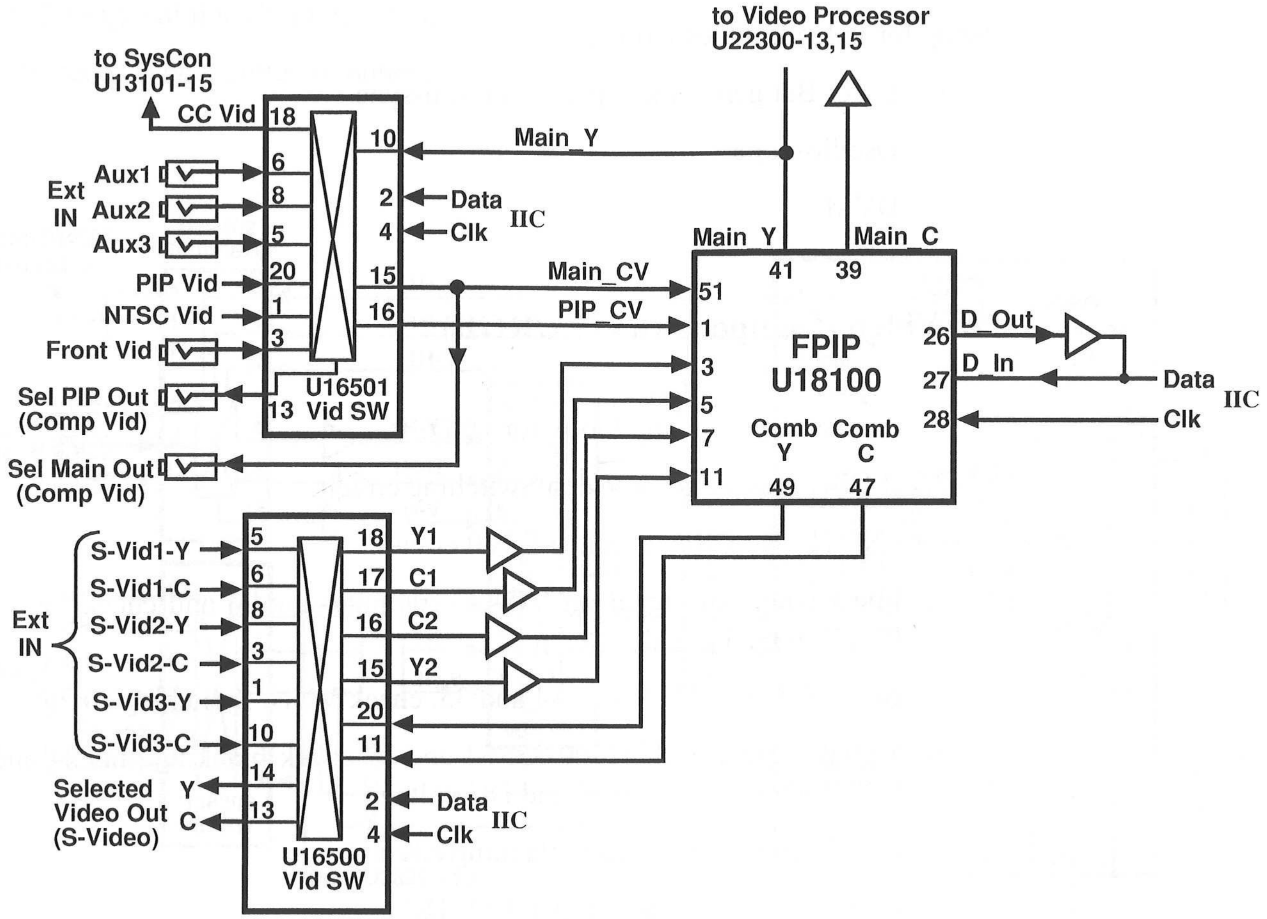

to Video Processor
U22300-13,15
to SysCon
U13101-15
CC Vid
18
10
Main_Y
Ext
IN
Aux1
Aux2
Aux3
6
8
5
2
4
Data
Clk
IIC
Main_Y
Main_C
PIP Vid
NTSC Vid
Front Vid
20
1
3
15
16
Main_CV
PIP_CV
41
39
51
1
3
5
7
11
FPIP
U18100
Comb
Y
Comb
C
49
47
26
27
28
D_Out
D_In
Data
Clk
IIC
Sel PIP Out
(Comp Vid)
13
U16501
Vid SW
Sel Main Out
(Comp Vid)
Ext
IN
S-Vid1-Y
S-Vid1-C
S-Vid2-Y
S-Vid2-C
S-Vid3-Y
S-Vid3-C
5
6
8
3
1
10
14
13
18
17
16
15
20
11
Y1
C1
C2
Y2
Selected
Video Out
(S-Video)
Y
C
2
4
Data
Clk
IIC
U16500
Vid SW

Figure 7, NTSC Video Switching and Processing Block Diagram

# Multimedia Monitor Video Troubleshooting (YUV/VGA/RGB)

Setup for video troubleshooting:

- Color Bar generator capable of multi-sync
- Oscilloscope
- DVM

## No Video (Component/VGA/RGB)

1. Access user menu and look for OSD.
2. If OSD present go to Video Switching circuit.

   NOTE: No OSD, check U22300 circuit.
3. Inject color bar signal on VGA1 (computer mode) and check for signal at U22300-33, 34, and 35.
4. No signal on U22300-33, 34 and 35, check Video Switching circuit.
5. Signal present on U22300-33, 34 and 35 check blanking pins 24 and 25 of U22300 for proper signal and DC voltage.
6. If Voltage missing, check blanking circuit.
7. Check U22300-32 for proper 3.5V DC.
8. Voltage low check Q22305 and associated circuits.
9. Check U22300-36 OSD FS for 0V dc.

   **NOTE:** DC on this pin will result in blanking of video. Signal should only be present when OSD is displayed.
10. Check U22300-41, 42 and 43 for signal.
11. No signal suspect U22300
12. Signals present check CRT drive circuit.

**NOTE:** Video in any one mode will indicate U22300 is working and the video switching circuit becomes suspect.

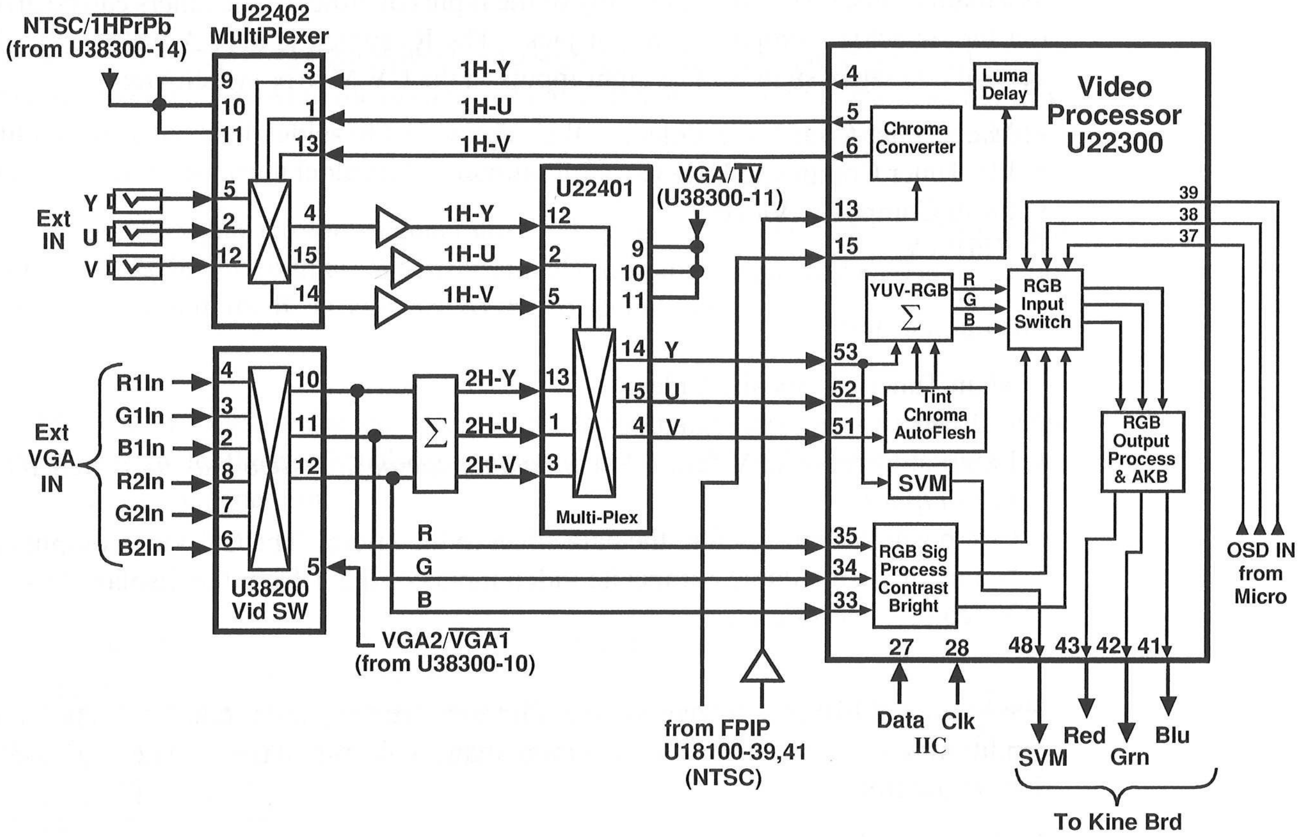
## Reported problems:

Q15180 purple picture after hot

R14755 poor washed out picture and dark picture

CR14502 Diagonal lines both directions

Q14370 Out of sync picture. (Connections)


NTSC/1HPrPb
(from U38300-14)
U22402
MultiPlexer
9
10
11
3
1
13
1H-Y
1H-U
1H-V
Ext
IN
Y
U
V
5
2
12
4
15
14
1H-Y
1H-U
1H-V
U22401
12
2
5
9
10
11
VGA/TV
(U38300-11)
14
15
4
Y
U
V
13
1
3
Multi-Plex
Ext
VGA
IN
R1In
G1In
B1In
R2In
G2In
B2In
4
3
2
8
7
6
10
11
12
5
U38200
Vid SW
Σ
2H-Y
2H-U
2H-V
R
G
B
VGA2/VGA1
(from U38300-10)
from FPIP
U18100-39,41
(NTSC)
Video
Processor
U22300
Luma
Delay
Chroma
Converter
4
5
6
13
15
YUV-RGB
Σ
R
G
B
RGB
Input
Switch
39
38
37
53
52
51
Tint
Chroma
AutoFlesh
SVM
RGB
Output
Process
& AKB
35
34
33
RGB Sig
Process
Contrast
Bright
27
28
48
43
42
41
Data
Clk
IIC
SVM
Red
Grn
Blu
To Kine Brd
OSD IN
from
Micro

**YUV/VGA/RGB Video Switching & Processing Block Diagram**

Figure 8, YUV/VGA/RGB Video Switching and Processing Block Diagram

## Video Input Switching Overview

The Multimedia Monitor is capable of accepting virtually any type of standard NTSC video input and several other common video inputs. These include a YUV (YPrPb) input (for DVD), VGA/SVGA computer inputs, VGA video to accept compatible digital TV set top box inputs, 3 composite video inputs (with S-Video (Y/C) capability), and standard NTSC broadcast video for the main and PIP tuners.

The composite video input switching network consists of U16501 and supports three rear jack panel inputs, a front panel input and two composite signals from the NTSC tuners (main & PIP). This arrangement will allow any composite signal to be displayed as a main or insert (PIP) picture. Any of the inputs or either of the tuners can be driven out the Selected Composite Output jack. The IC switch is a TEA-6415C, 8x6 bus controlled matrix switch. The eight inputs to the CV Matrix switch are:

- Main Tuner Composite Video,
- PIP Tuner Composite Video,
- Front Composite Video,
- YPrPb Y.

The outputs are:

- Main Tuner Composite Video,
- PIP Tuner Composite Video,
- External Composite Video, *(Only incoming composite video may be switched to this output.)*
- Composite Video signal to the data slicer in the micro. The CC Video output can be any of the available composite video inputs or the Y from the displayed S-Video or YPrPb signal.

The Main and PIP tuners have mute ability to reduce any cross talk from a no-signal condition were the tuners may output more than 2 volts p-p of noise. The mute control lines come from U22407.

S-Video Switch, U16502 supports three rear panel jacks, sharing the audio inputs with their respective composite video inputs. Combed Y/C from the optional Frame Comb is also input to this switch. An auto detection scheme will select S-Video over composite video if sync is detected on the corresponding Y/C input. Registers are provided to report the status of the sync detectors present on the two S-Video inputs routed to U18100.

U22402 switches between composite or S-Video signals that have been converted to YUV format and the rear jack panel YPrPb inputs.

# Multimedia Monitor Video Switching Troubleshooting

Setup for video troubleshooting:

- Color Bar generator capable of multi-sync
- Oscilloscope
- DVM

There is no easy quick way to troubleshoot a signal switching circuit. It is point-to-point troubleshooting. Knowing the ins and outs of a switching circuit helps in signal flow but knowing the truth tables of the switching IC's is critical. The proper service data should be used for truth table and switching information.

Using a known signal (Color bar generator) and a good scope, start at the first input and work towards the final output. When the signal is missing at a particular IC use the truth table to make sure the IC is switched to the correct mode.

**NOTE:** The first input is the jack itself where the signal generator is connected. This not only eliminates the jack but also gives a good indication of what the signal looks like coming from the generator.

Device/Mode Pin Number

| U38300 | 9 | 10 | 11 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|
| TV | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| CV | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| YPrPb | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| VGA1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
| VGA2 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

Figure 9, Truth Table for U38300

Device/Mode Pin Number

| U38301 | 9 | 10 |
|---|---|---|
| TV | 0 | 1 |
| CV | 0 | 1 |
| YPrPb | 0 | 1 |
| VGA1 | 1 | 0 |
| VGA2 | 1 | 1 |

Figure 10, Truth Table for U38301

# *Introduction*

The ***DTV306 / DTV307*** are TCE's 16X9, HDTV televisions capable of receiving and displaying standard NTSC, current formats of the digital ATSC and DBS. The DTV306/DTV307 architecture is based on the MMC101G for the DTV306 and MMC102(G) for the DTV307. Changes to the "MMC" chassis are reduction of parts on the In/Out board and the addition of the DM1. The DM1, or Digital Module, was first used as the main signal processor in the DTV300. NTSC, ATSC and DBS processing are all incorporated in the DM1. This manual will focus on the DM1 and it's power supply. Troubleshooting to determine if the DM1 or the chassis is the problem will be the center topic with little discussion on the chassis. Additional information on the DTV chassis can be found in the MMC101G/MMC102(G) Technical Manual.

# *Chassis Description (DTV)*

There is little difference in the version of the MMC chassis used as the building block for the DTV. Board layout is the same in both the DTV and MMC chassis. With the addition of the DM1 for signal processing, the DTV chassis has fewer parts. The main areas of change are Deflection, System Control and In/Out circuits.

### *DM1 Description*

The Digital Module (DM1) decodes digital audio and video from Direct Broadcast Satellite (DBS) and terrestrial ATSC Digital Television (DTV) transmissions. NTSC audio and video are digitized by the DM1 and upconverted to analog Y I/Q at 2H. Audio processing is full 5.1-channel, AC-3 decoding, Pro-Logic decoding and down mixing. Audio output is analog baseband signals, optical AC-3 digital signal and optical uncompressed digital PCM signal.

**Note:** *The DM1 is **not** field serviceable; however, this manual will provide basic information to troubleshoot the DM1 module for replacement. Consult the latest ESI for the DM1 part number.*

### *Deflection Modes*

Deflection modes are reduced to three; 4, 14 and 15. Mode 4 is for DM1 and modes 14 and 15 are for DVD 2H and 2.14H (Y Pr Pb).

| Deflection Mode | Format | Horiz Scan Rate (KHz) | Vert Scan Rate (Hz) | H-Res (dots) | V-Res (dots) |
|---|---|---|---|---|---|
| 4 | DTC100 (SDTV) | 32.6 - 33.75 | 60 | 1920 | 540 |
| 4 | DTC100 (HD) | 32.6 - 33.75 | 58.1 - 62 | 1920 | 1080 |
| 14 | EIA 770.1 DVD | 29.0 - 32.6 | 58.1 - 62 | 720 | 480 |
| 14 | EIA 770.2 DVD | 29.0 - 32.6 | 70.08 | 720 | 480 |
| 15 | EIA 770.3 | 32.6 - 36.5 | 58.1 - 62 | 1920 | 1080 |

*Figure 1-1, Deflection Modes (DTV)*

### *System Control*

The chassis micro now becomes a slave micro controlling chassis functions, switching, timing, etc. while the main micro is in the DM1. Communication throughout the chassis is via I$^2$C bus. As with the "MMC" chassis, the chassis EEPROMs store chassis alignment information. The majority of the alignments and adjustments for the DTV are performed by using the service menu or Chipper Check™ . Accessing the DTV service menu is different from the "MMC" chassis. To access the service menu on the DTV chassis press TV-DIRECT and CH down buttons at the same time. The rest of the service menu structure is the same as the "MMC" chassis. The DM1's service menu is independent of the chassis service menu. The *Troubleshooting System Control section covers the* DM1 service menu in detail.

### *In / Out Board*

The back panel has changed from the MMC version. The VGA, USB and G-Link connections have been removed. Other inputs are the same. *See Figure 1-2.*

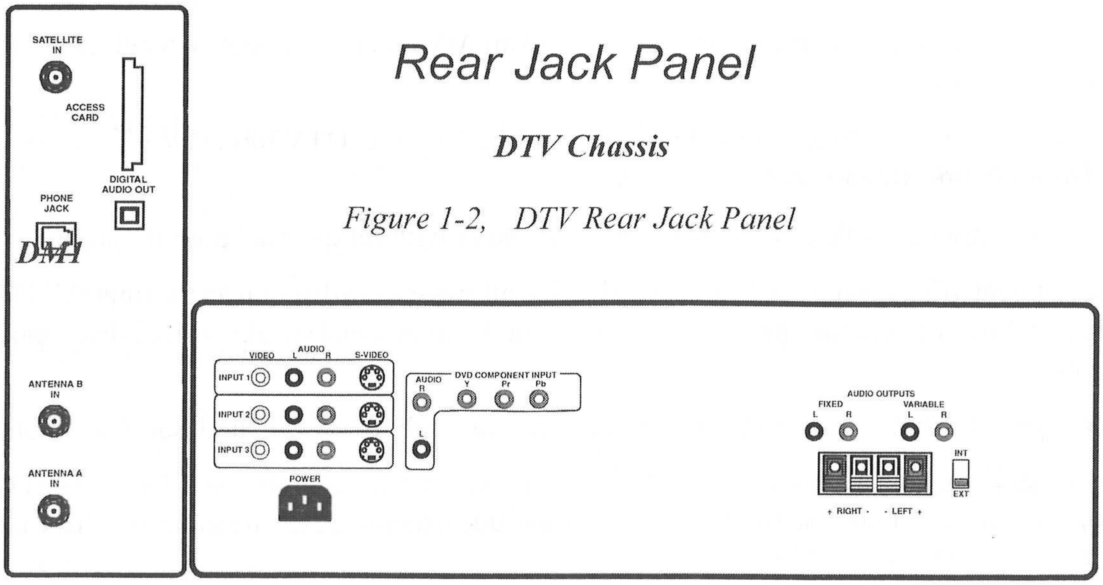
***Audio/Video Composite Inputs (3):*** Accepts standard baseband video and matching audio from any device with compatible outputs.

***S-Video (3):*** Accepts S-Video inputs from any device having compatible S-Video outputs. If a live S-Video input is detected, the appropriate video input is automatically switched from component to S-Video.

***Note:*** *Both Video and S-Video may have connections and live inputs, however the DTV will select S-Video over composite any time a valid S-Video signal is present on the jack.*

***DVD Component Video & Audio Input:*** Accepts high quality YPrPb video from a DVD player or other device with matching outputs. The YPrPb inputs may be 1H, 2H or 2.14H and has matching audio inputs.

***Phone Jack:*** Connected to standard phone line for DBS features. Modem speed is 2400 bps and detects phone usage before calling out.


SATELLITE IN
ACCESS CARD
DIGITAL AUDIO OUT
PHONE JACK
DM1
ANTENNA B IN
ANTENNA A IN
VIDEO
AUDIO
L
R
S-VIDEO
INPUT 1
INPUT 2
INPUT 3
POWER
AUDIO
R
L
DVD COMPONENT INPUT
Y
Pr
Pb
AUDIO OUTPUTS
FIXED
VARIABLE
L
R
L
R
INT
EXT
+ RIGHT -
- LEFT +

Rear Jack Panel

***DTV Chassis***

*Figure 1-2, DTV Rear Jack Panel*

## *Interprocessor Communications Protocol (ICP) used in DTV306 and DTV307*

Inter-processor Communications Protocol (ICP) is the communications bus between the DM1 micro and the DTV chassis micro. ICP uses four lines for communication instead of the two found in the more common $I^2C$ bus. The four lines used for ICP are called: ICP_REQUEST, ICP_CLOCK, ICP_Tx (Transmit) and ICP_Rx (Receive). An ICP message can have up to 15 bytes total. The first byte is a count of the number of command and data bytes that follow it. The second byte is the command and the subsequent bytes are data for the command.

The ICP_REQUEST is active low and remains low for the entire ICP transmission. The DM1 micro is the bus master and controls this line. Taking the line high indicates the end of data transmission from the DM1 to the TV micro.

ICP_CLOCK is used to clock in and clock out data and commands.

ICP_Rx is data received from the TV micro to the DM1 micro.

ICP_Tx is data transmitted from the DM1 micro to the TV micro.

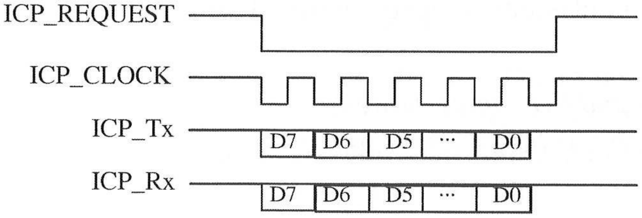

ICP_REQUEST
ICP_CLOCK
ICP_Tx
D7
D6
D5
···
D0
ICP_Rx
D7
D6
D5
···
D0

*Figure 1:Timing for ICP*

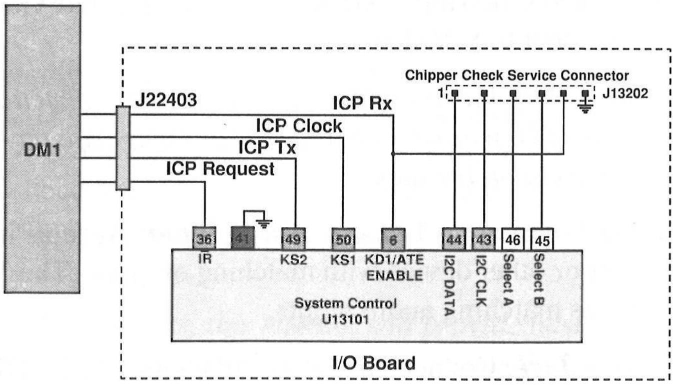

DM1
J22403
ICP Rx
ICP Clock
ICP Tx
ICP Request
Chipper Check Service Connector
1
J13202
36
IR
41
49
KS2
50
KS1
6
KD1/ATE ENABLE
44
I2C DATA
43
I2C CLK
46
Select A
45
Select B
System Control
U13101
I/O Board

*Figure 2:DM1 to DTV chassis ICP connections*

### *Audio Outputs*

***Fixed:*** Provides a fixed-level audio output for connection to an A/V receiver. The A/V receiver would then be used for volume control.

***Variable:*** Provides an audio output whose level is controlled by the DTV306/DTV307 volume level adjustment. Also for connection to an A/V receiver.

***Ext Speaker:*** Audio output capable of driving external speakers without external amplification.

***EXT/INT Switch:*** Located beside the EXT SPEAKER jacks, allows user to disconnect the internal DTV306/ DTV307 speakers in favor of external speakers. EXT sends audio to external speakers. INT disconnects any external speakers.

***Digital Audio Output:*** Toslink connection for optical audio out, only for ATSC and Satellite reception.

There are "hidden" jacks on both the DTV306 and DTV307, these are referred to as Front Jacks. The DTV307 front connections are located under the front panel. They include headphones, video/audio. These jacks are located on the left hand side of the DTV306.

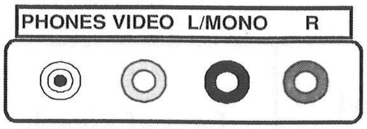


*Figure 1-3, "DTV" Front I/O*

*The DTV306/DTV307 uses "Hot" and "Cold" grounds. Training material and service data will continue to differentiate between the two using ↓ for hot ground and ⏚ for cold. Always use an isolation transformer when performing service on the DTV series chassis.*

## *DTV Key Differences Vs MM/MMC*

Based on the "MMC" chassis, the DTV is a high resolution television in 16x9 format. Like the MMC chassis the DTV is capable of 1080i and 540p. Unlike the "MMC", the DTV is not a computer monitor. The VGA inputs and USB ports have been removed. The Digital Module (DM1) processes *all* incoming audio and video signals except for 2H and 2.14H Y Pr Pb.

There is an additional switch mode power supply in the DTV chassis. This power supply provides power to the DM1. Power requirements for the DM1 are: +33VsDM, +21VsDM, +12VsDM, +5VsDM, -5VsDM and +3.3VsDM.

The DM1 provides NTSC, ATSC and DBS signal processing.

System control is in the DM1. Customer interface is via FPA and IR. These signals are received and processed by the DM1.

Satellite input, phone hookup and Access card are used for DBS signal processing.

The DM1 has it's own fan that is on when AC power is applied to the set.

NTSC (1H) is upconverted by the DM1 to 540p (2H) and sent to the chassis for display.

Display is 16x9 screen format, with format options when the signal is in standard 4x3 mode.

Audio processing includes full 5.1-channel AC-3 decoding, Pro-logic decoding and down mixing. Audio output is analog baseband (Chassis), optical AC-3 digital and optical uncompressed digital PCM signal (Toslink).

## *DM1 Overview*

The DM1 module decodes digital audio and video from Direct Broadcast Satellite (DBS) and terrestrial ATSC Digital TV (DTV) transmissions. It also digitizes analog audio and video from standard NTSC sources, such as cable and terrestrial broadcasts. It includes an integral control system, user interface and on screen display. DM1 signal types are listed in Figure 2-1.

## *DM1 Input Signal Levels*

The tuner section of the DM1 is divided into three sections, all requiring slightly different RF levels for proper operation. The table below indicates nominal signal conditions for each of three signal types: DBS, ATSC and NTSC. If the conditions are not met for any reason, the tuners will react differently. Satellite installers typically use power levels (dBm) and RF antenna and MATV installers generally use voltage levels (dBuV). Both are shown in the table.

| Signal Type | Signal Level Voltage (dBuV) | Signal Level Power (dBm) | Loss of Signal Indication |
|---|---|---|---|
| Satellite DBS | 40 dBuV - 86 dBuV | -69 dBm to -23 dBm | On-Screen "Searching for Satellite" |
| Terrestrial NTSC VHF | 26 dBuV - 102 dBuV | -83dBm to -7dBm | Snow |
| Terrestrial NTSC UHF | 30 dBuV - 95 dBuV | -79 dBm to -14 dBm | Snow |
| Terrestrial Digital ATSC | 30 dBuV - 95 dBuV | -79 dBm to -14 dBm | On-Screen "No or Weak Signal" |

*Figure 2-1, RF Signal Levels*

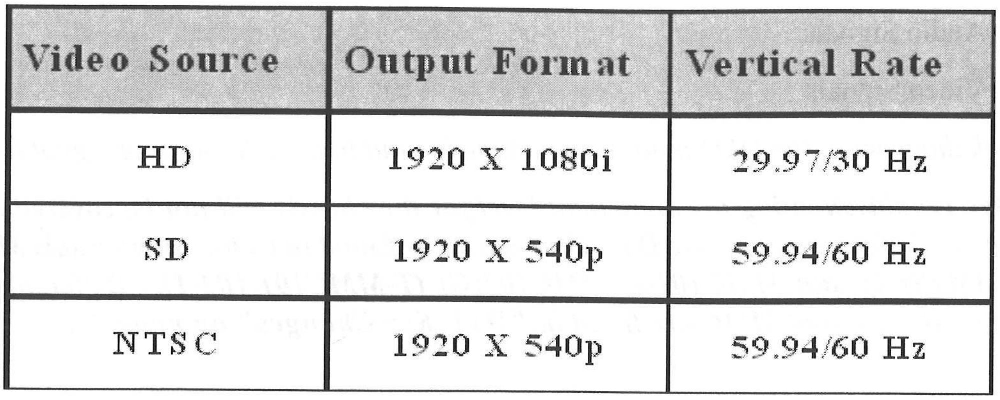
## *Bit Error Rate (BER)*

The Bit Error Rate (BER) meters, located in the consumer menus, give an accurate indication of digital signal levels, but do not measure actual RF levels. They measure the percentage of digital signal correctly decoded which is an indirect measure of the quality of the RF signal. The signal may be captured at about 40 BER and once captured, will hold onto the signal till about 30. DBS signals in the continental US should be at least 70 while ATSC signal levels are still too new to establish a pattern. The capture capability of the ATSC tuner is similar to the DBS tuner as far as BER, however the terrestrial ATSC signal can be captured at lower RF levels than DBS.

***Remember the signal meters in the consumer menu will register only digital RF signals. The meters are set up to monitor the BER of digital signals, not the RF envelope of analog.***

## Video Processing

Video is upconverted and output as analog Y Pr Pb (Y IQ for NTSC sources) at 2H in one of the following formats:



| Video Source | Output Format | Vertical Rate |
|---|---|---|
| HD | 1920 X 1080i | 29.97/30 Hz |
| SD | 1920 X 540p | 59.94/60 Hz |
| NTSC | 1920 X 540p | 59.94/60 Hz |

*Figure 2-2, Video Formats*

## Audio Processing

Audio processing includes full 5.1-channel AC-3 decoding and Pro-Logic decoding. Audio is output as analog baseband signals, as an optical AC-3 digital signal and as an optical uncompressed digital Pulse Code Modulation (PCM) signal.

***Supported decoding modes***:

- *Direct Broadcast Satellite (DBS) Stereo MPEG-1 layer 2 elementary stream with system layer syntax.*
- *DBS multi-channel AC-3 elementary stream with MPEG-2.*
- *HDTV multi-channel AC-3 elementary stream with MPEG-2.*
- *NTSC stereo A/D input with 50mS time delay to compensate for video 1H to 2.14H conversion delays.*

## *Manual Overview*

This manual will cover troubleshooting the DTV306 / DTV307 to determine if the chassis or the DM1 module is the problem.

Troubleshooting DM1 sections covered in this manual are:

- Power Supply
- System Control
- Audio Signals
- Video Signals

*Block diagram of the DM1 module is included to aid in troubleshooting signal flow.*

**Note:** ***Troubleshooting to component level for the chassis will not be covered in this manual. Information on the DTV chassis can be found in technical manuals MM101 (T-MM101-1) and MMC101G, MMC102(G) (T-MMC101/102-1). Differences between the DTV and MMC are listed in "DTV Key Changes" on page 47.***

# NOTES

# DM1 Power Supply Circuit Description

The power supply used for the DM1 is a flyback-type, current-mode controlled, zero voltage switching (ZVS) topology utilizing a discrete control circuit and cold-side regulation. Three post regulators, U14105 (+12V), U14104 (+3.3V) and U14103 (-5V) provide regulation under heavy loads. The +21VsDM supply the LNB switch regulator U24502 that has logic selectable output voltage of +13.5 volts or +18.5 volts. The +21VsDM also provide voltage for the cooling fan. Other voltages include +33VsDM for NTSC tuner operation and +5VsDM.

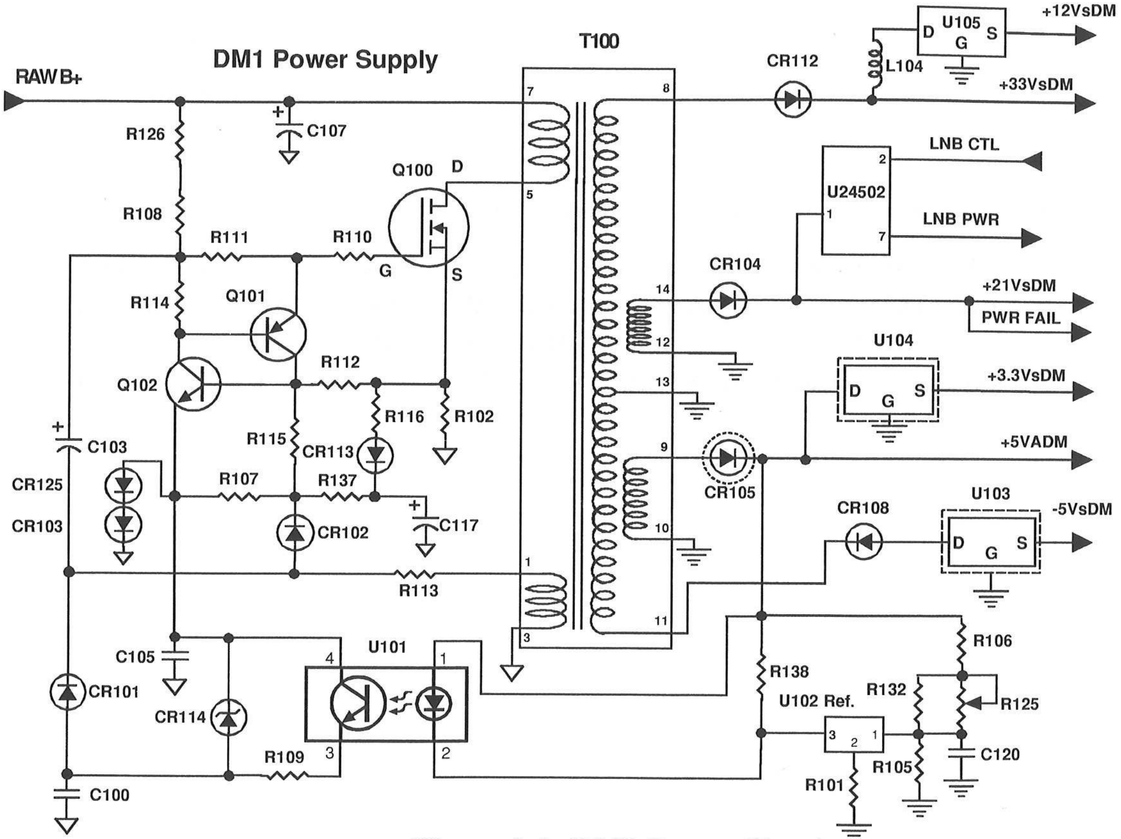

DM1 Power Supply
RAW B+
T100
R126
C107
R108
Q100
D
G
S
R111
R110
R114
Q101
Q102
R112
R116
R102
R115
CR113
C103
R107
R137
CR125
CR103
CR102
C117
R113
C105
CR101
CR114
U101
R109
C100
CR112
L104
U105
+12VsDM
+33VsDM
LNB CTL
U24502
LNB PWR
CR104
+21VsDM
PWR FAIL
U104
+3.3VsDM
+5VADM
CR105
CR108
U103
-5VsDM
R106
R138
U102 Ref.
R132
R125
R105
C120
R101

*Figure 3-1, DM1 Power Circuit*

## Regulation

Cold-side regulation comes from a three-terminal error amplifier, U14102. U14102 senses the +5V supply and provides feedback to the control circuit Q14101, Q14102, Q14105 and Q14106 via photo-coupler U14101. R14125, B+ adjust, sets the regulated output of the power supply. The **+5VADM** (CR14105-K) is set to +5.1V by adjusting R14125.

## Power Fail

A power fail signal (J14100-1) is provided as advance warning of imminent supply voltage dropout. The +3.3VsDM and +5VsDM will remain for about 20ms after PWR_FAIL signal is asserted allowing system control time to batten down the hatches. The PWR_FAIL signal is an open collector output with a 2.2K pull-up to the +21VsDM supply. Figure 3-2 shows the threshold levels for PWR_FAIL.

| PWR_FAIL Mode (J14100 pin 1) | AC Power Status | Comments |
|---|---|---|
| 27V | Normal | Normal Operation |
| 20V | Losing Power | Below 20V Q14103 conducts |
| 10V | Power Fail | |

*Figure 3-2, Power Fail Modes*

TECH TIP

**Note:** The DM1 power supply can be operated without the DM1 connected. All voltages will be correctly regulated with no load.

## LNB Power

LNB power (J14102-6) is controlled by the logic level on U24502-2. In troubleshooting for only partial DBS channel reception, U24502 is the first place to check. The switching from Right Hand Channel Polarization (RHCP) to Left Hand Channel Polarization (LHCP) is controlled by U24502's output voltage. If the output voltage is correct for both modes then the LNB would be suspect. The truth table for the control and output is in Figure 3-3.

| Polarization | LNB_CTL | LNB Power |
|---|---|---|
| RHCP | <= +0.8V | +13.0V |
| LHCP | >= +2.4V | +18.0V |

*Figure 3-3, LNB Power Control*

TECH TIP

Figure 3-4 shows useful troubleshooting information for the DM1 power supply. Resistance measurements are referenced to cold ground.

| Test Point | Supply | Max Load (mA) | Voltage Tolerance | Resistance (DM1 connected) |
|---|---|---|---|---|
| U104 (2) | +3.3V | 2200 | 3% | 250 ohms |
| CR105 (K) | +5.1V | 1500 | 3% | 29 ohms |
| U105 (3) | +12.0V | 580 | 5% | 600 ohms |
| U103 (3) | -5V | 180 | 5% | 6.7k ohms |
| CR104 (K) | +21V | 500 | 5% | 7.8k ohms |
| CR106 (K) | +33V | 60 | 5% | 71k ohms |

*Figure 3-4, Resistance Readings*

## *Start-up Troubleshooting*

Power supply start-up is based on Q100 turn on. This requires enough gate drive to turn on Q100.
Follow these steps to determine Start-up operation.

1. Apply 90VAC to AC Plug.
2. Check Drain Voltage on Q100. (Aprox 160Vdc)
3. Remove AC power.
4. Monitor Gate voltage of Q100 and apply 90VAC to AC Plug. A small pulse of dc at about 3V turns on Q100.
5. No gate voltage, check R126, R108, R111 and R110.
6. If Voltage is present and drains off, check for an open Q100 or R102.

Note: Figure 3-5 shows the basic start-up components.

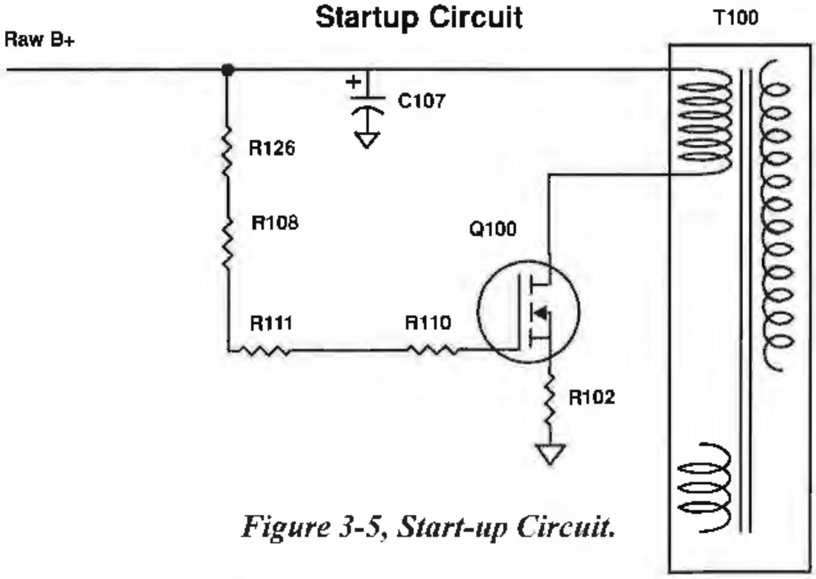


*Figure 3-5, Start-up Circuit.*

***Note: ZVS power supply can be damaged by bringing it up at AC levels below 90VAC.***

## *Regulation Troubleshooting*

Regulation is based on the +5VADB supply. As this voltage changes U101 conducts more or less providing feedback to the primary side for regulation. Troubleshooting is in two parts. The first part being the secondary side components and the second being the primary side.

***Setup: Disconnect DM1 from power supply board. Remove AC plug from power supply board.***

## *Part 1 Regulation Troubleshooting*

1. Connect a variable DC supply to the cathode of CR105 and cold ground.
2. Connect an ohm meter across pins 3 and 4 of U101 photo-coupler.
3. Starting at 0V slowly increase DC supply till U101 conducts. (Indicated by ohm meter reading near 0 ohms)
4. Measure the voltage from the power supply. A 5Vdc to 5.1Vdc indicates feed back circuit to U101 is working correctly. Go to part 2
5. All other readings check U102, R105, R101, U101, R105, and R125.

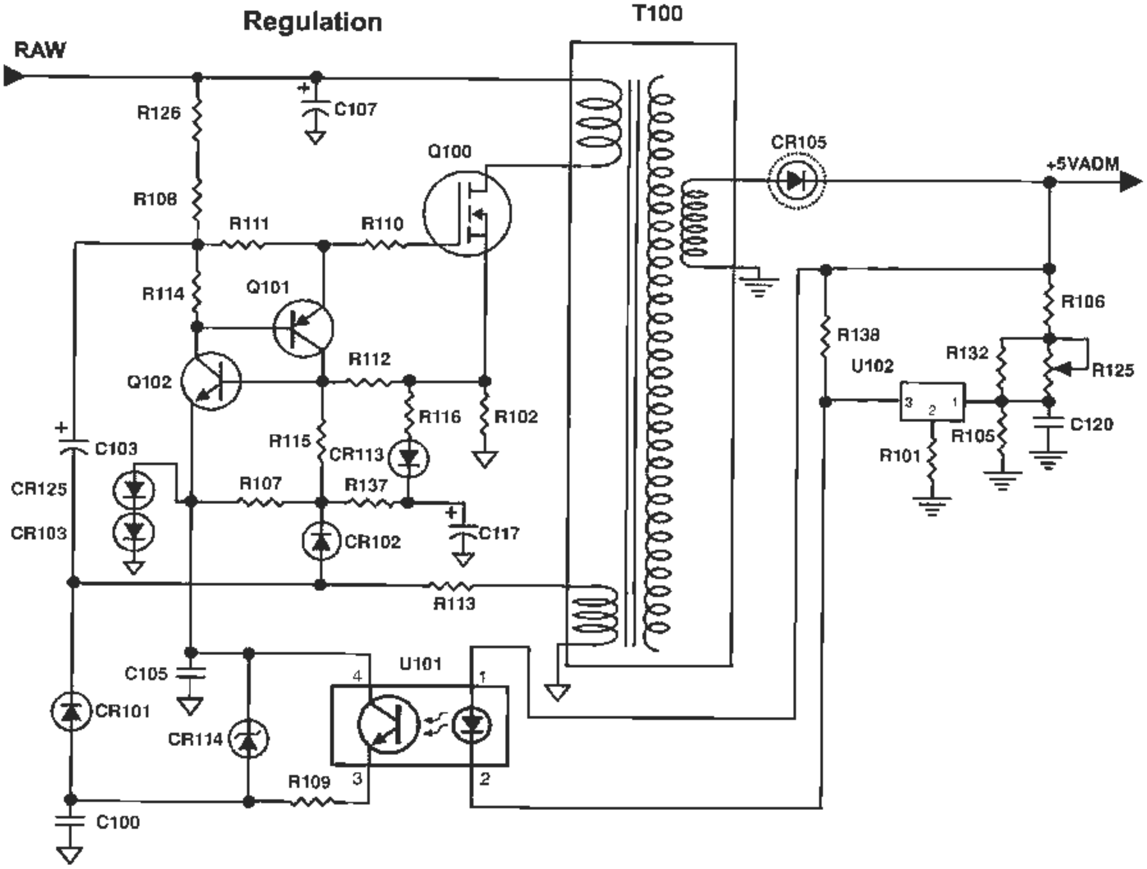

Regulation
T100
RAW
R126
C107
Q100
CR105
+5VADM
R108
R111
R110
R114
Q101
R106
R138
U102
R132
R125
Q102
R112
R116
R102
R115
CR113
R137
3
2
1
C120
R105
R101
C103
CR125
CR103
R107
CR102
C117
R113
U101
4
1
C105
CR101
CR114
R109
3
2
C100

*Figure 3-6, Regulation Circuit*

## *Part 2 Regulation Troubleshooting*

Primary side troubleshooting is based on static checks of all active components. If Q100 fails, Q101 and Q102 need to be replaced.

1. Verify the zener value of CR114.
2. Check Q101, Q102 and associated components.
3. Check CR101, CR102, CR103, CR113 and CR125.
4. Check R109 and R113.

Using the resistance chart of Figure 3-8, verify resistance reading to hot ground

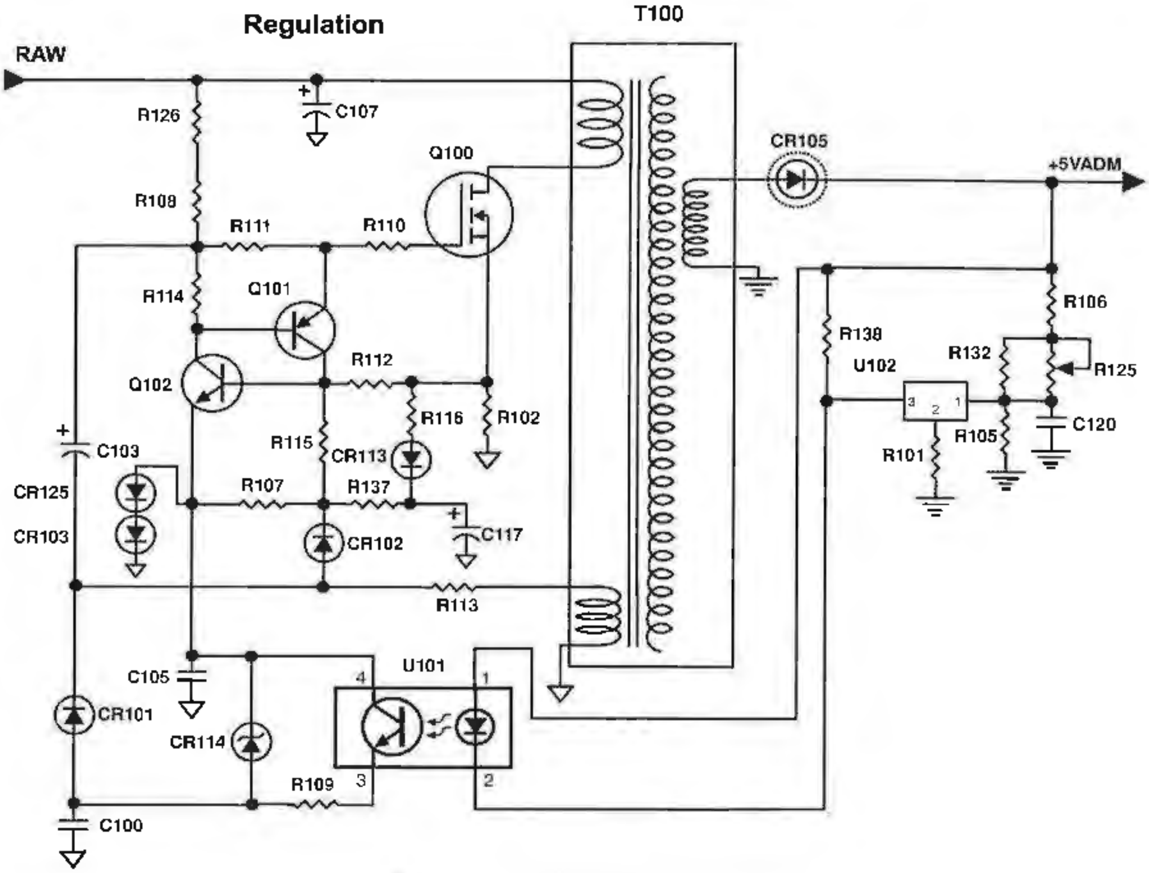

Regulation
T100
RAW
R126
C107
Q100
CR105
+5VADM
R108
R111
R110
R114
Q101
R106
R138
U102
R132
R125
Q102
R112
R116
R102
C120
R105
R101
C103
R115
CR113
CR125
R107
R137
CR103
CR102
C117
R113
C105
U101
4
1
CR101
CR114
R109
3
2
C100

*Figure 3-7, Regulation Circuit*

## *All readings referenced to hot ground.(▽)*

TECH
TIP

| Test Point | Resistance |
|---|---|
| Q100 (D) | Infinity |
| Q100 (G) | Infinity |
| CR113 (K) | 23k ohms |
| U101 (4) | 21k ohms |
| U101 (3) | 1.4M ohms |
| C103 (+) | Infinity |

*Figure 3-8, Resistance readings key components.*

## Shutdown

Shutdown occurs when Q100 draws enough current through R102 to produce source voltage. As the source voltage increases, Q102 starts to conduct. With Q102's emitter going to ground through CR125 and CR103, Q102's collector approches ground turning on Q101. As Q101 conducts, Q100's gate drive decreases turning off Q100.

*Note:* ***Over current shutdown shows up as pulsing supply.***

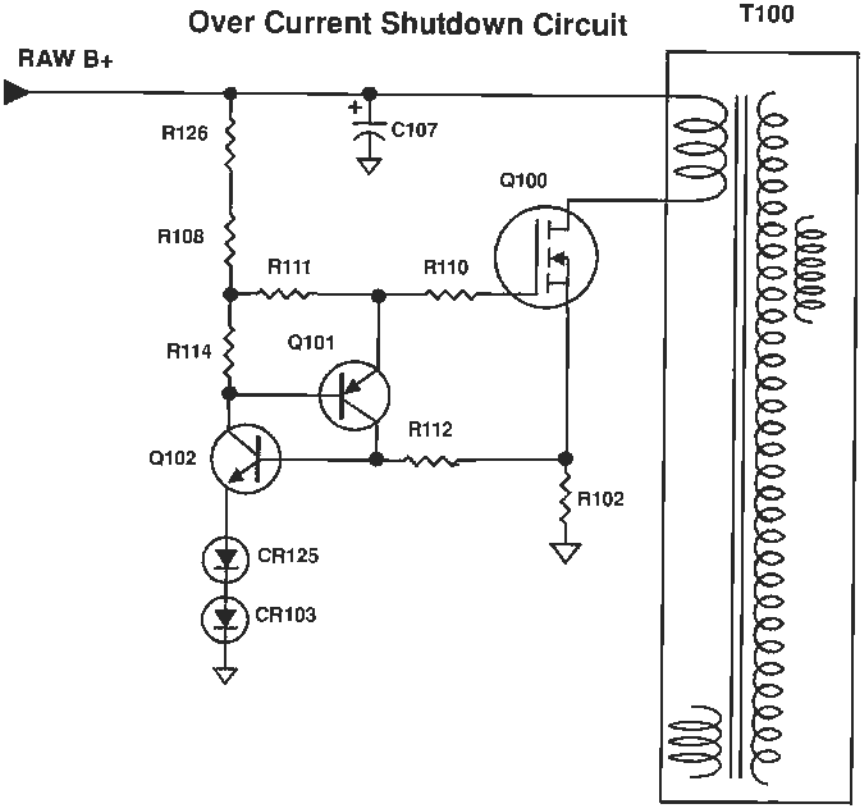
**T**
**TIP**

## Troubleshooting Over Current Shutdown

1. Check for any shorts on the secondary side of T100. (See Figure 3-4 for resistance readings)
2. Check R102 for correct value.
3. Check T100 for primary to secondary shorts.

## Over Voltage Shutdown Troubleshooting

A pulsing power supply with voltage on the secondary indicate over voltage shutdown. Over voltage shutdown indicates a regulation problem. See section on regulation troubleshooting.



Over Current Shutdown Circuit

*Figure 3-9, Over Current Shutdown Circuit*

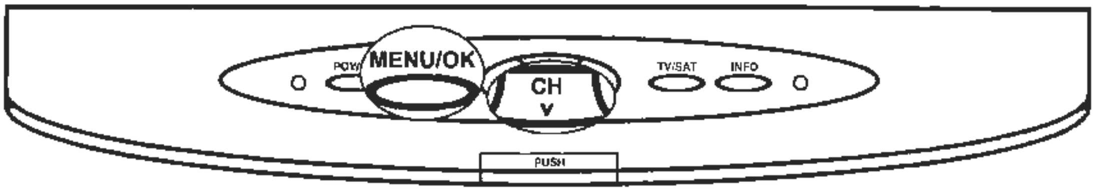


*Figure 4-1, DM1 Service Mode Key Press*

***Note: Art work in this section may not directly represent the actual TV set style; however, the menu and key functions are correct.***

## *DM1 Service Mode*

The test and diagnostic service mode, for the DM1 module, is entered by pressing MENU/OK and CH DN at the same time, then quickly releasing both. There is a short time delay before the menu is displayed.

The following menu items will be shown on-screen plus one additional indicated by the "down" arrow at the bottom of the list. To access the selections use the cursor button on the remote control or the CH UP or CH DN buttons on the front panel. Once the selection is highlighted, initiate the function by pressing OK on the remote control or MENU/OK on the front panel. In some cases where multiple functions are available use the "cursor right" button on the remote or the VOL UP button on the front panel to move the highlight over to the selection on the right side of the screen. When the operation is complete use the cursor left button on the remote or the VOL DN button on the front panel to return to the main DM1 Service Mode Menu.

The following test functions are available in the DM1 Service Mode.

### *1. Service Test*

Provides a more "robust" system test than the consumer version. Hardware tests for such things as video and system RAM, DM1 EEPROM and a more detailed phone line/modem check.

### *2. Information*

Accessed by pressing "OK" the test returns information about the DTV and DM1 module. The important information for the service technician is the numbers after ROM. They will appear as:

**ROM:** 028a **A 0 4.37** B 0 3 . 0 7 MC 000

The **A 0 4.37** is the operating code revision currently in use by the DM1.

### *3. Odometer*

The odometer reading indicates the date the chassis was first activated and the number of hours it has been plugged in since that date.

### *4. Test Patterns*

There are various test patterns generated internally by the DM1 module available for checking geometry and color temperature setup. The patterns are useful for performing many of the DTV field alignments.

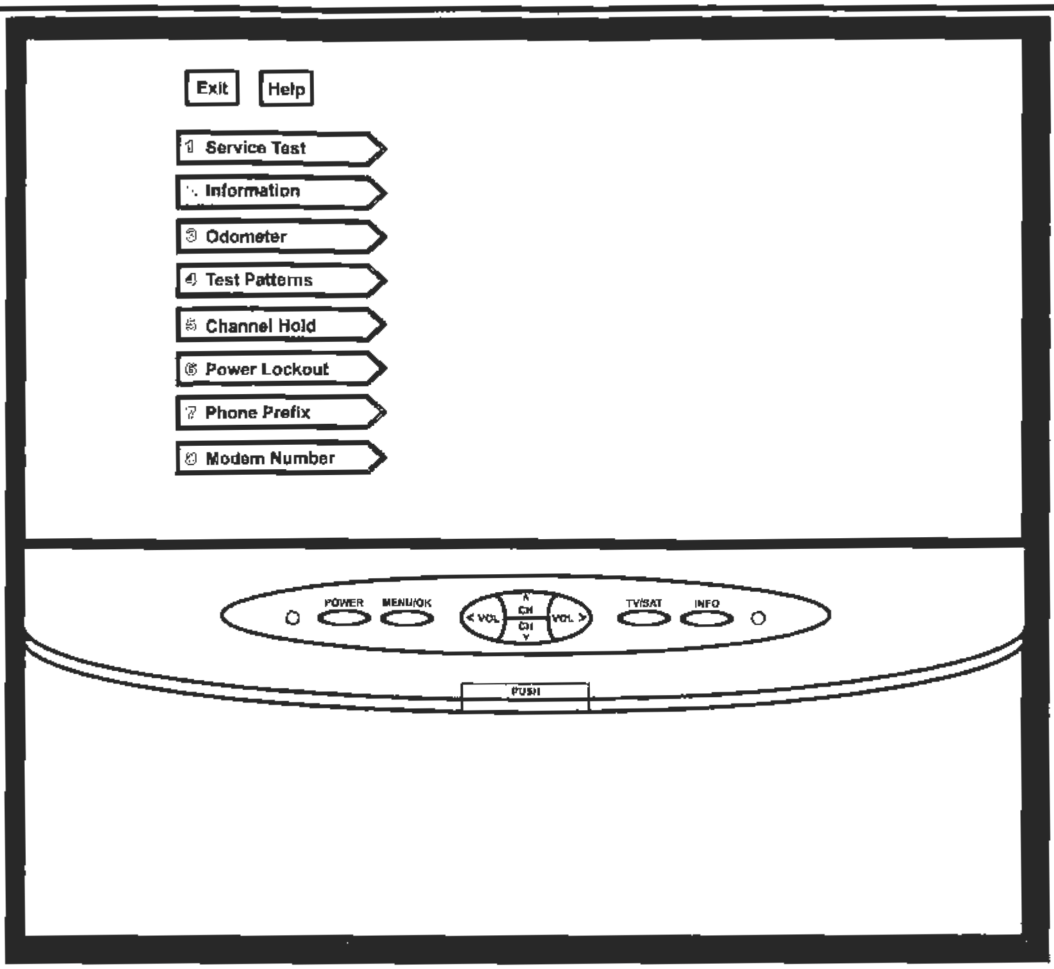

Exit
Help
1 Service Test
2 Information
3 Odometer
4 Test Patterns
5 Channel Hold
6 Power Lockout
7 Phone Prefix
8 Modem Number
POWER
MENU/OK
VOL
CH
TV/SAT
INFO
PUSH

*Figure 4-2, Service Menu Display*

### *5. Channel Hold*

Allows a technician to return the DTV to a designated channel (off-air or DBS) any time the set is on, after a specified length of time if no other on-screen activity or to return it to a specified channel after shut down or power loss. This would be more applicable on a sales floor than a consumer situation. It would allow the dealer to lock the set on a specific channel, or return to a specific channel after allowing consumers to "surf" or otherwise play with the instrument.

### *6. Power Lockout*

Prevents operation of the front panel and remote control POWER button. Also useful on the sales floor to prevent undesired shutoff of the set.

### *7. Phone Prefix*

Allows user to submit a prefix code in front of the outgoing phone number if required. The most common use might be a "9" required by some business phones to access an "outside" line.

### *8. Modem Number*

Number used by "Modem Test".

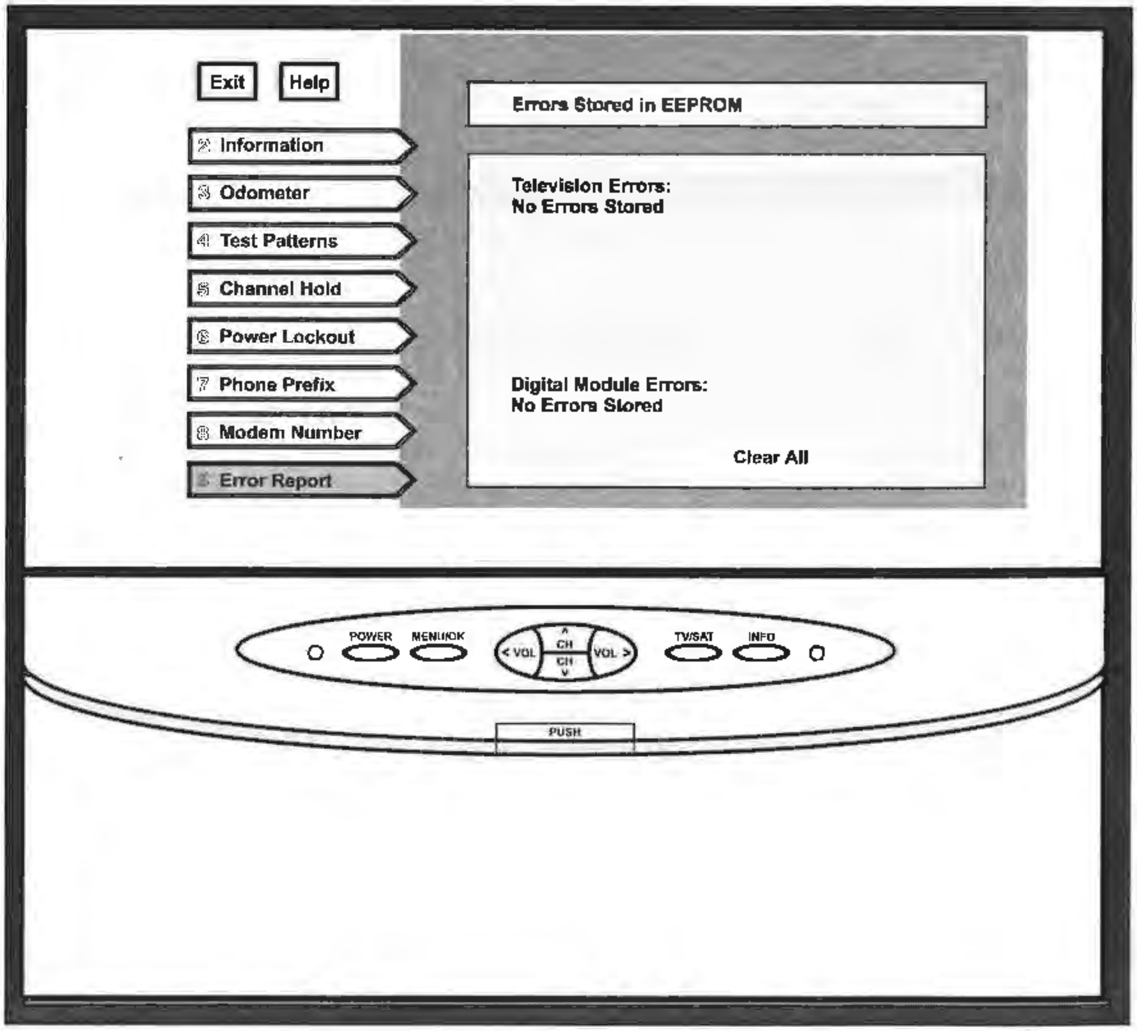
***9.Error Report:*** *Currently not available.*

## *SAT CHANNEL MAP*

One further DM1 test to aid technicians is accessed through the service test menu. It can indicate which channels are being received on each DBS satellite transponder and may be useful to troubleshoot DBS reception problems.

**To Enter the Test:**

1. Enter the DM1 Service Test menu by pressing the front panel buttons, MENU/OK and CH DN at the same time.
2. Navigate down to the "Error Reports" test menu. DO NOT PRESS ANY OTHER BUTTONS AT THIS TIME!


Exit
Help
2 Information
3 Odometer
4 Test Patterns
5 Channel Hold
6 Power Lockout
7 Phone Prefix
8 Modem Number
9 Error Report
Clear All
POWER
MENU/OK
< VOL
CH
CH
VOL >
TV/SAT
INFO
PUSH

Errors Stored in EEPROM

Television Errors:
No Errors Stored

Digital Module Errors:
No Errors Stored

*Figure 4-3. Error Report Selection*

3. Press the number "8" button on the remote control.

   A new menu item called "SAT CHANNEL MAP" will now appear directly above the "Error Report" menu item. The number ID for the individual selections disappear at this point.
4. The SAT CHANNEL MAP menu will already be selected.
5. Enter the SAT CHANNEL MAP menu by pressing the "Cursor Right" or "OK" button on the remote control. The menu will appear as in Figure 4-4.

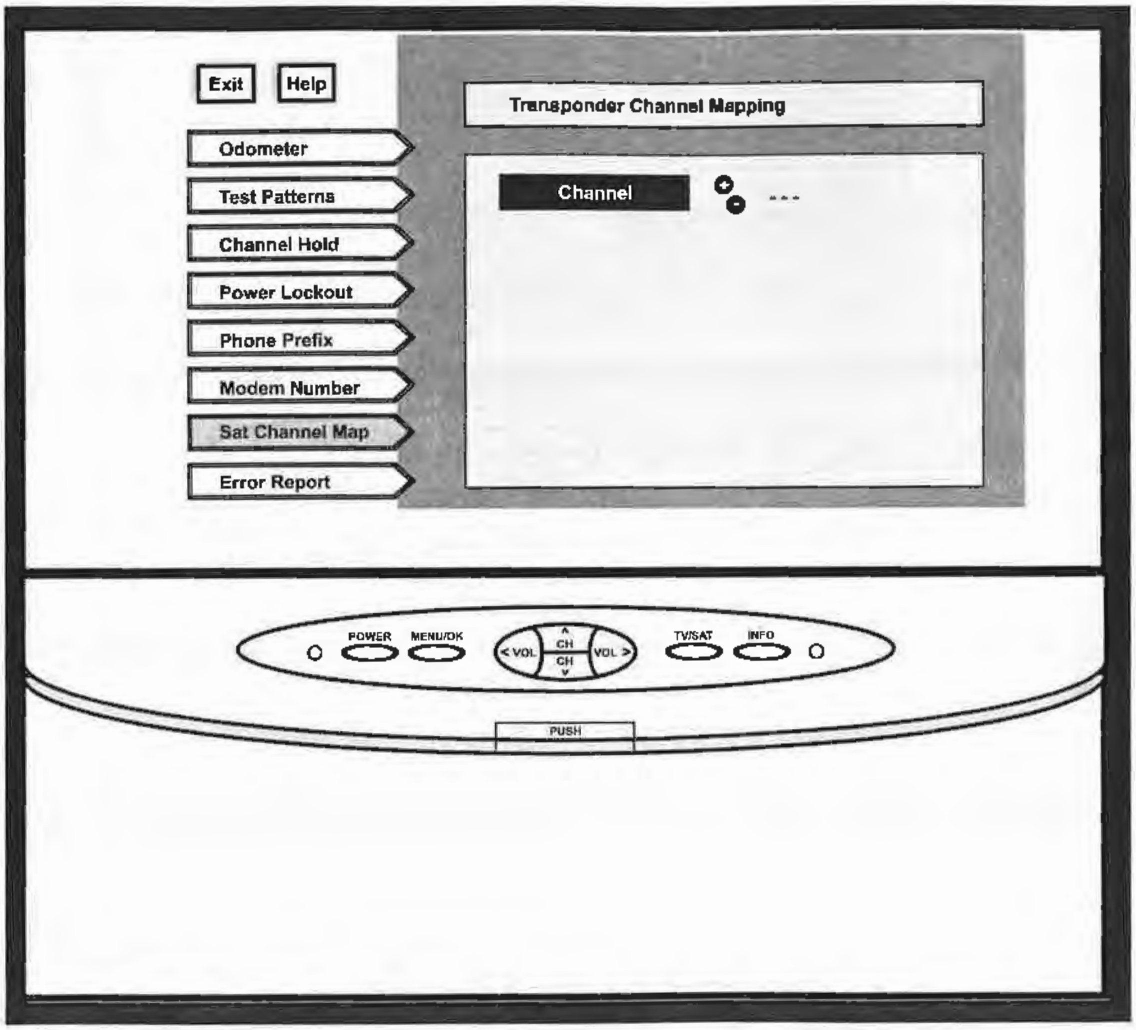

Exit
Help
Transponder Channel Mapping
Odometer
Test Patterns
Channel Hold
Power Lockout
Phone Prefix
Modem Number
Sat Channel Map
Error Report
Channel
---
POWER
MENU/OK
< VOL
CH
CH
VOL >
TV/SAT
INFO
PUSH

*Figure 4-4, SAT CHANNEL MAP Selection*

6. When the "Channel" selection is highlighted, press OK to change it to "Transponder".
7. Enter the transponder select area by pressing "Cursor Right" on the remote control. The + and dashed lines should now be highlighted.

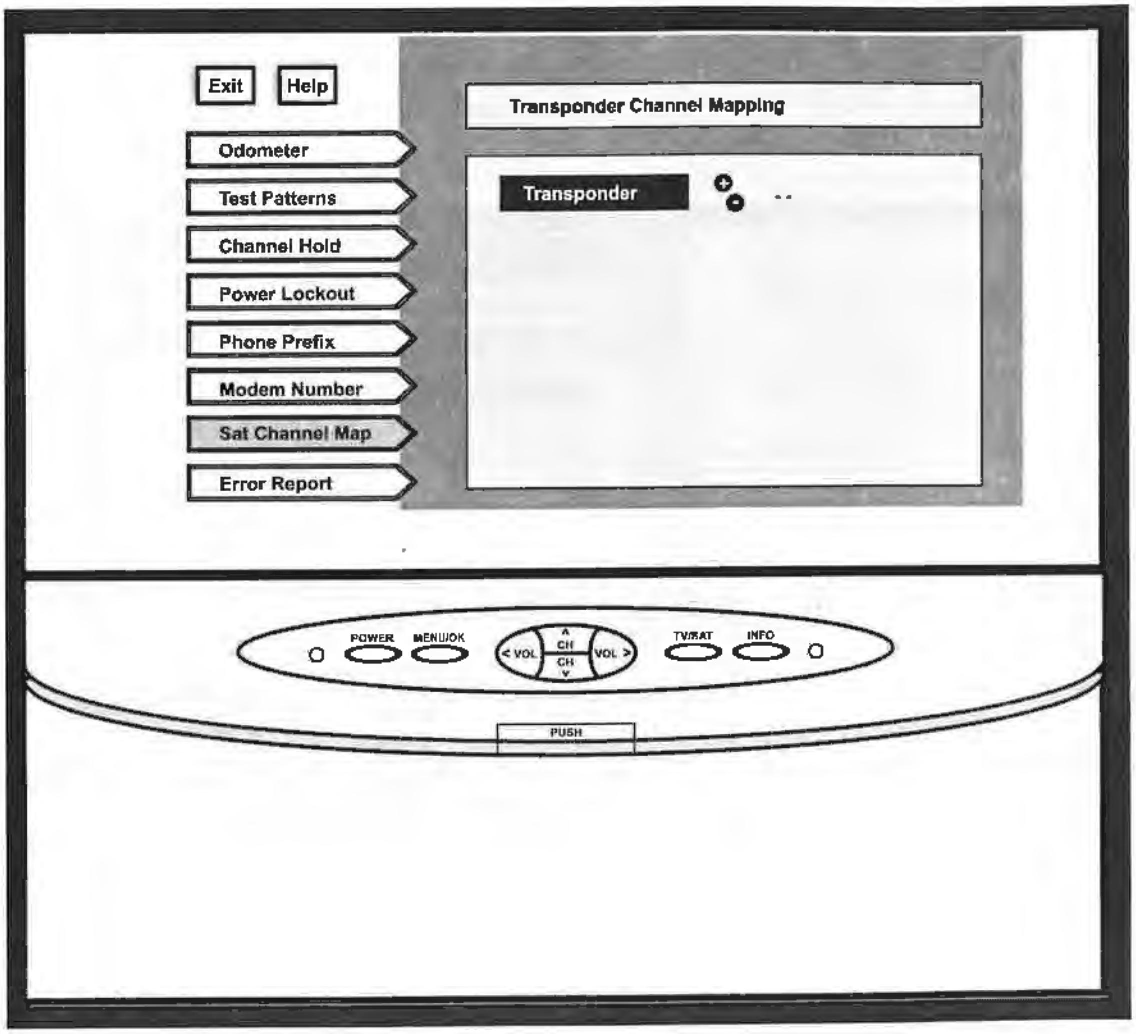
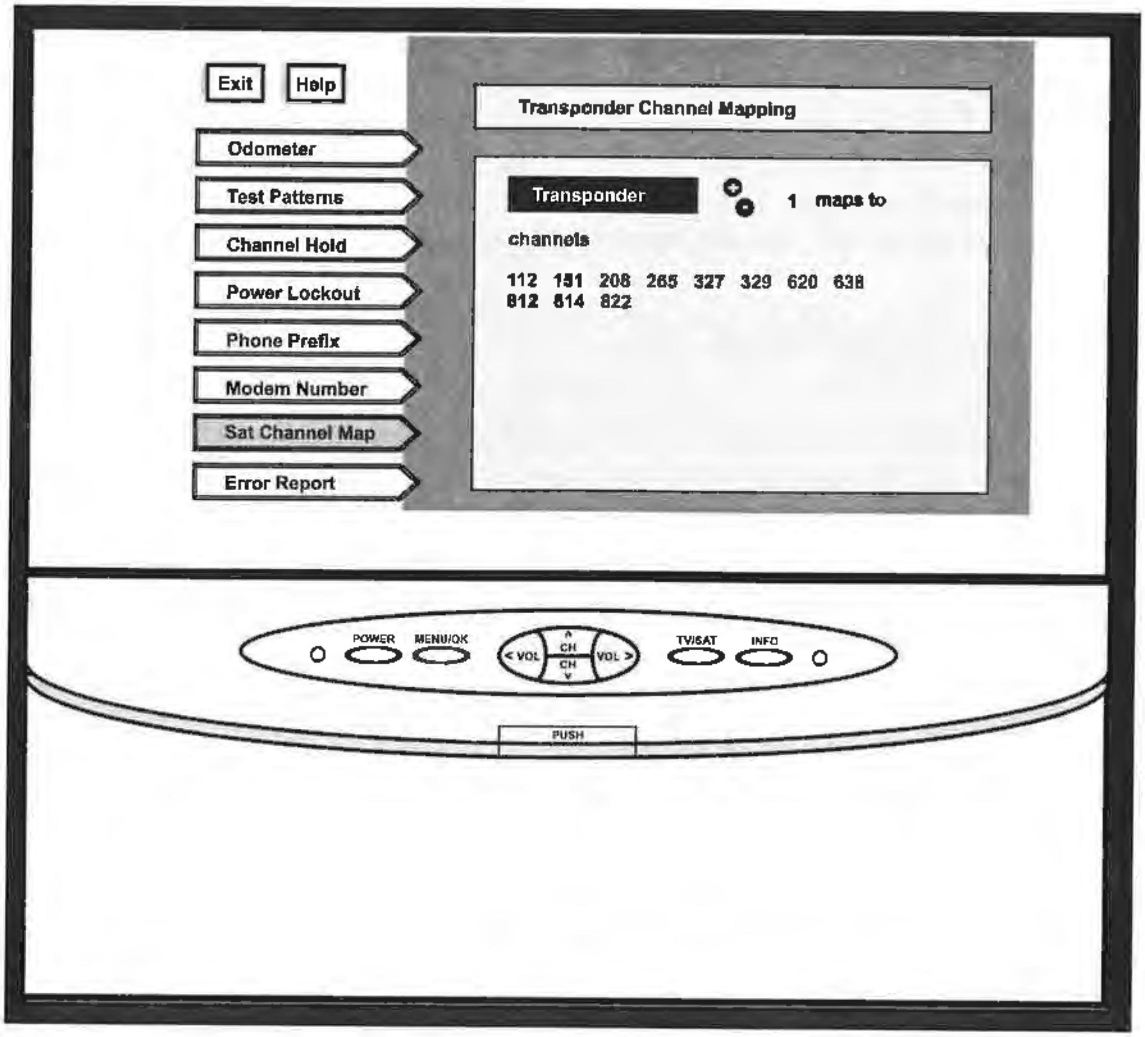

Exit
Help
Odometer
Test Patterns
Channel Hold
Power Lockout
Phone Prefix
Modem Number
Sat Channel Map
Error Report
Transponder Channel Mapping
Transponder
+
-
--
POWER
MENU/OK
CH
VOL
TV/SAT
INFO
PUSH

*Figure 4-5. Change "Channel" to "Transponder"*

8. Press "OK" on the remote control to change the transponder number. Each press will increment the transponder number by one. It may take a few seconds for a complete channel list for each transponder to display.
9. Change the selection from "Transponder" back to "Channel" by pressing the "Cursor Left" button on the remote control to highlight the "Transponder" box.
10. Press "OK" on the remote control and the box will change to "Channel".
11. Use the "Cursor Right" button on the remote control to highlight the + and --- lines.

**NOTE:** *When returning from the "Transponder" selection, the channel indicator will default to channel 100. When the channel selection is entered from the start of the menu, it will not indicate a channel.*

12. Press "OK" on the remote control to increment up the channel list. Channel numbers maybe entered directly using the number buttons on the remote control. Channels not in the list or not available will be indicated by "This channel not found".



Exit
Help
Odometer
Test Patterns
Channel Hold
Power Lockout
Phone Prefix
Modem Number
Sat Channel Map
Error Report
Transponder
POWER
MENU/OK
< VOL
CH
CH
VOL >
TV/SAT
INFO
PUSH

Transponder Channel Mapping

Transponder 1 maps to

channels

112 151 208 265 327 329 620 638
812 814 822

*Figure 4-6, Change "Channel" to "Transponder"*

There are limitations of the test.

1. It cannot differentiate between the 101 degree satellite cluster and the 119 degree satellite. When incrementing through the transponders, the 119 degree transponders are not included. However, when incrementing through the channel list, if a channel is located on the 119 degree satellite, the correct transponder number will be shown, but with no indication of the satellite.
2. There is no indication of right or left polarities available, only the transponder number.
3. If the satellite signal is removed, the last valid channel map will remain. If there was never a channel map established, no channels will be shown.
4. If the Access Card is invalid, no channel map or the last valid channel map will be shown.

## *Software Updates*

One of the greater advantages of software control is the ability to update the operating system. The DM1 tuner module contains flash ROM which is updatable with new code to improve performance, add features or remove bugs. There are two methods of performing the updates. First, it may be downloaded through a satellite signal. Second is through the use of a "*Paddle*" update card placed in the "*Smart Card*" slot in the rear of the set.

*To upgrade the DM1 module software;*

1. Apply AC power to the set but do not turn on the set.
2. Remove the Access Card from the Digital Module on the rear of the set.
3. Insert the *"Upload Paddle"* (in the same direction as you would an Access Card) into the DM1 Access Card Slot.
4. Preform a warm reset by pressing the POWER and CH DN buttons at the same time. Release the power button and continue to hold the CH DN button until the POWER LED illuminates.
5. Release the CH DN button. The upload process takes approximately 2 minutes. When the POWER button LED goes off, the software download to the DM1 is complete
6. Unplug the television again.
7. Remove the Upload Paddle and reinsert the customer Access Card.
9. Plug in the television. This completes the update.

*Upon completion of the upload, verify the update was successful.*

1. Turn on the television.
2. Press and hold the MENU and CH DN buttons on the front of the television simultaneously to access the DM1 Service Menu.
3. Select "System Test" and press MENU/OK (on the TV) or OK (on the remote).
4. Read across on the second line of text, labeled "ROM", and look for the appropriate code version. The ROM revision numbers are in the following format: Axx.xx Bxx.xx. The "A" number is the revision and should match the revision just loaded. If it does not, perform the upgrade process again.

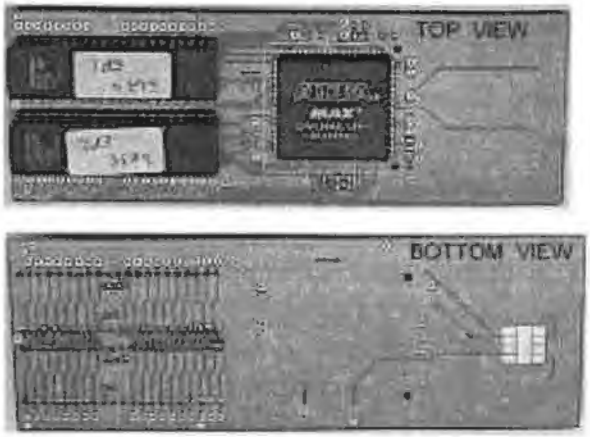


*Figure 4-7, Upload Paddle*

***Note:*** *Lock up during a down load process occurs when the power LED remains on and no other functions work. Doing the software upgrade over will correct this problem.*

**TECH TIP**

## *System Control Troubleshooting (DM1)*

With any system control type problem the main CPU circuit becomes suspect. since the DM1 has the main CPU in it, the DM1 would be prime suspect. To check for system control operation of the DM1 when the set will not turn on:

1. Disconnect J22600 from the chassis.
2. Push power button on FPA or remote. Power LED lights?

***Power LED lights:***

3. If power LED lights, check for clock and data on pins 3 and 4 of J22600. Signal present, DM1 is trying to communicate with U13101 chassis cpu. Chassis would be suspect if LED is on and Clock / Data signals are present on J22600.

***Power LED does not light:***

4. LED not on, DM1 is suspect.

***Note:*** *The DM1 will function without being connected to the DTV chassis. The power indicator indicates that the DM1 system control is working.*

**TECH TIP**

The block diagram of Figure 4-8 shows what sections are in the DM1 and which are in the chassis. ARM/Transport block is the system control for DM1 and the DTV chassis. There is no field repair of the DM1. The HDTV block diagram is for visual understanding of what the DM1 does. Any problems that lead to the DM1 module, the DM1 should be replaced.

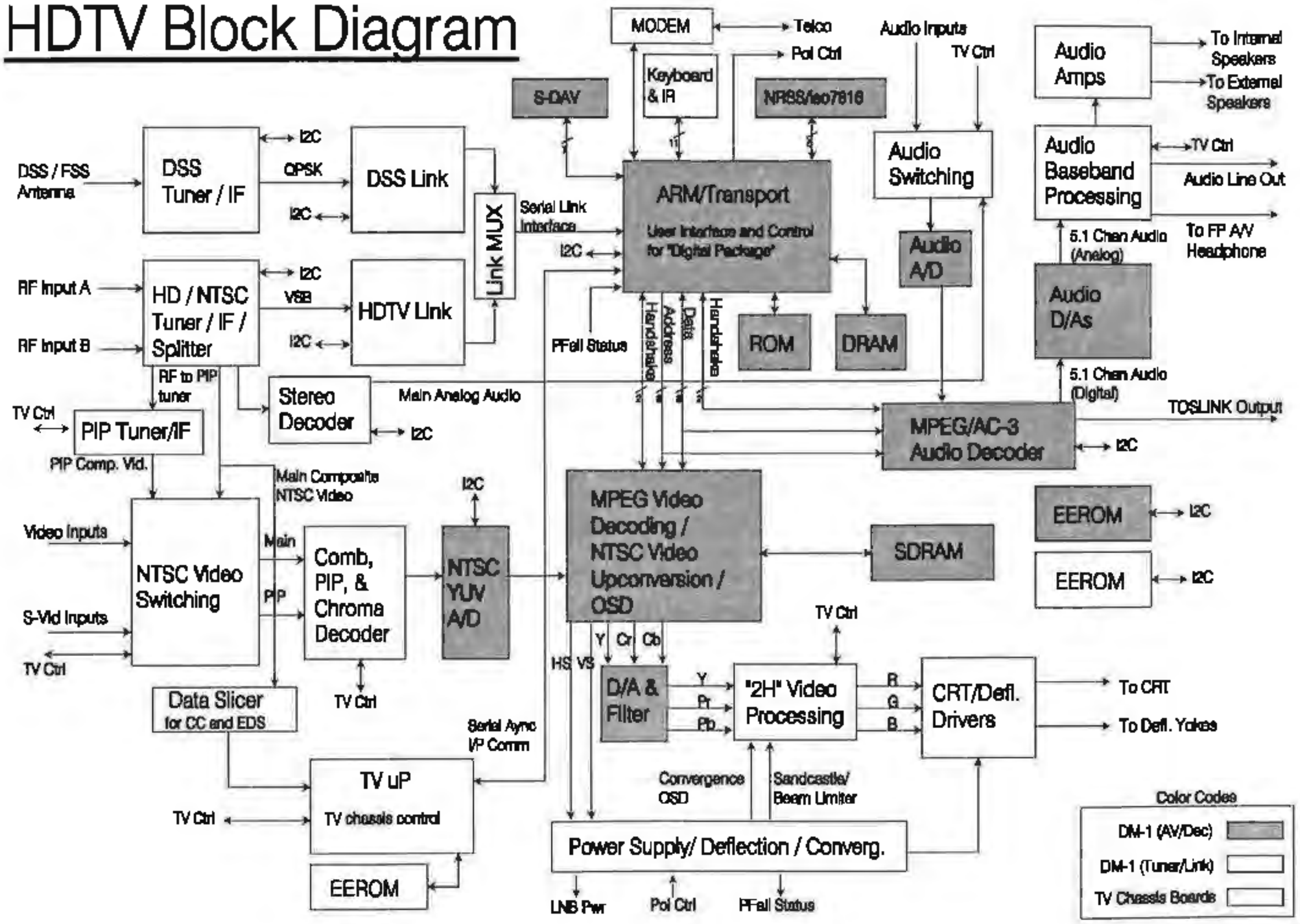

HDTV Block Diagram
MODEM
Telco
Pol Ctrl
Keyboard & IR
S-DAV
NRSS/iso7816
Audio Inputs
TV Ctrl
Audio Switching
Audio Amps
To Internal Speakers
To External Speakers
Audio Baseband Processing
TV Ctrl
Audio Line Out
To FP A/V Headphone
5.1 Chan Audio (Analog)
Audio D/As
5.1 Chan Audio (Digital)
TOSLINK Output
DSS / FSS Antenna
DSS Tuner / IF
I2C
QPSK
DSS Link
I2C
Link MUX
Serial Link Interface
I2C
ARM/Transport
User Interface and Control for "Digital Package"
Audio A/D
RF Input A
RF Input B
HD / NTSC Tuner / IF / Splitter
I2C
VSB
HDTV Link
I2C
PFail Status
Handshake
Address
Data
Handshake
ROM
DRAM
RF to PIP tuner
Stereo Decoder
Main Analog Audio
I2C
TV Ctrl
PIP Tuner/IF
PIP Comp. Vid.
MPEG/AC-3 Audio Decoder
I2C
Main Composite NTSC Video
I2C
Video Inputs
NTSC Video Switching
Main
PIP
S-Vid Inputs
TV Ctrl
Comb, PIP, & Chroma Decoder
NTSC YUV A/D
MPEG Video Decoding / NTSC Video Upconversion / OSD
SDRAM
EEROM
I2C
EEROM
I2C
TV Ctrl
Data Slicer for CC and EDS
TV Ctrl
Serial Async I/P Comm
HS
VS
Y
Cr
Cb
D/A & Filter
Y
Pr
Pb
TV Ctrl
"2H" Video Processing
R
G
B
CRT/Defl. Drivers
To CRT
To Defl. Yokes
TV uP
TV chassis control
TV Ctrl
EEROM
Convergence OSD
Sandcastle/ Beam Limiter
Power Supply/ Deflection / Converg.
LNB Pwr
Pol Ctrl
PFail Status
Color Codes
DM-1 (AV/Dec)
DM-1 (Tuner/Link)
TV Chassis Boards

*Figure 4-8, HDTV Block Diagram*

# NOTES

## *Audio Signal Processing*

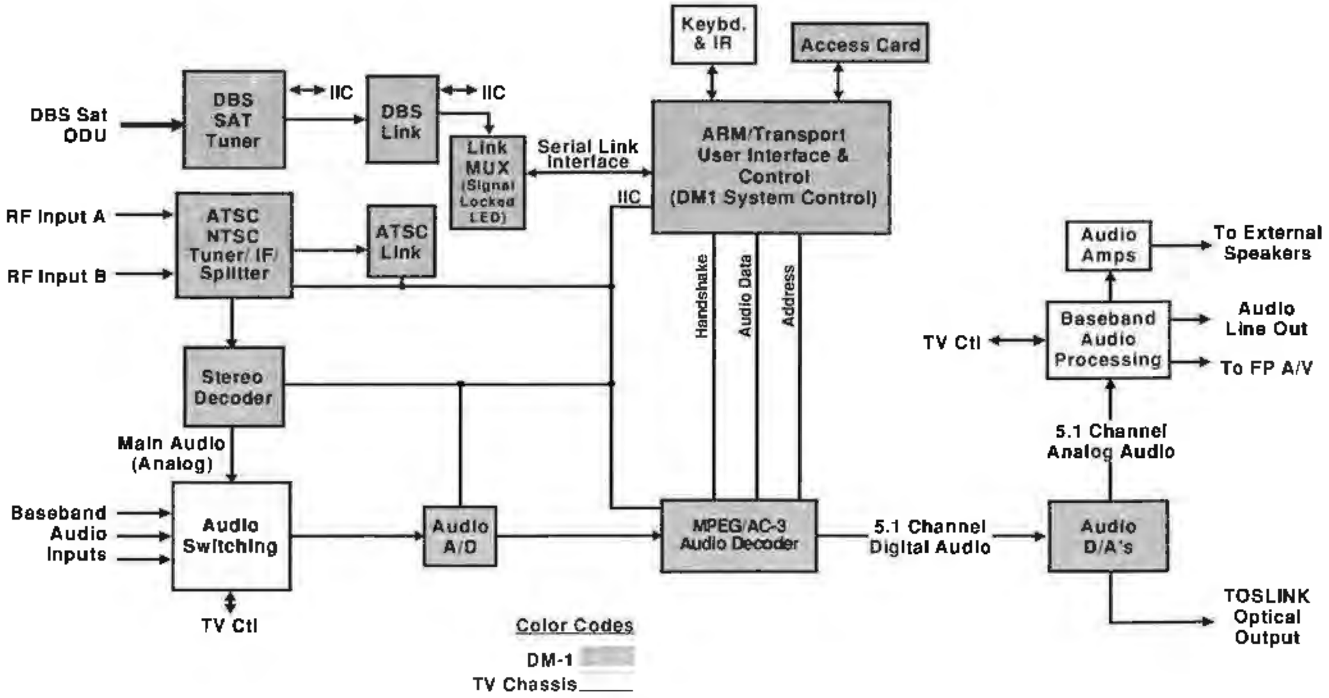
The DTV handles incoming audio from the digital tuner sources (ATSC and DBS) differently from NTSC and baseband sources. Incoming audio accompanying baseband video sources is processed by the main chassis via DM1 control. Standard NTSC audio is stereo decoded by the DM1, then sent to the audio processing circuits of the main chassis for output.

5.1 channel audio from digital sources is converted to analog audio by the DM1 prior to being sent to the main chassis for tone/volume/balance control and final amplification to speaker levels. A digital audio output is available directly from the DM1. This TOSLINK optical output contains 5.1 channel audio from the AC-3 decoder. It also carries a stereo signal during any non-AC3 digital reception.

Baseband audio is converted to digital for processing by the AC-3 decoder if such information is contained by the signal. Otherwise the stereo signal is passed back to the chassis after the DM1 converts it from digital back to audio. All further audio processing is done by the chassis.

## *Audio Signal Switching*

Switching is controlled by the main chassis via the IIC bus however, the main chassis is in turn controlled by the DM1 ARM.



Keybd. & IR
Access Card
DBS Sat ODU
DBS SAT Tuner
IIC
DBS Link
IIC
Link MUX (Signal Locked LED)
Serial Link Interface
ARM/Transport User Interface & Control (DM1 System Control)
RF Input A
RF Input B
ATSC NTSC Tuner/ IF/ Splitter
ATSC Link
IIC
Handshake
Audio Data
Address
Audio Amps
To External Speakers
TV Ctl
Baseband Audio Processing
Audio Line Out
To FP A/V
Stereo Decoder
5.1 Channel Analog Audio
Main Audio (Analog)
Baseband Audio Inputs
Audio Switching
Audio A/D
MPEG/AC-3 Audio Decoder
5.1 Channel Digital Audio
Audio D/A's
TV Ctl
TOSLINK Optical Output
Color Codes
DM-1 ▨
TV Chassis ☐

*Figure 5-1. Audio Processing Block*

## *Audio Signal Troubleshooting*

In audio troubleshooting knowing what audio looks like on a scope will help in determining if audio signal is present or not. When troubleshooting audio an AF generator and scope are key test equipment. In this section a scope and stereo amp will be used. The stereo amp should be capable of optical input (Toslink) but not required. As with all troubleshooting sections this one will make every attempt to cover all possible scenarios.

### *No audio any mode*

1. Tune instrument to receive a known good stereo station.
2. Check for audio signals on J11402 pins 5, 6, 7 and 8.
3. No audio signal replace DM1
4. Audio on J11402 pins 5, 6, 7 and 8 troubleshoot DTV chassis.

### *Audio on analog channels only.*

1. Tune instrument to receive a known good AC-3 digital station.
2. Connect stereo receiver to optical out of DM1.
3. No audio signal replace DM1.
4. Audio signal present, check J11402 pins 5, 6, 7 and 8.
5. No audio signal at J11402 replace DM1.

### *Distorted Audio*

1. Conncer a 1Khz AF signal to Aux. 1 input.
2. Tune instrument to receive Aux. 1 input.
3. Check for proper waveform on J11402 pins 5, 6, 7 and 8.
4. Clean signal troubleshoot DTV chassis.
5. Distorted waveform replace DM1.

## *Video Signal Processing*

All baseband level signal processing is handled by the main chassis. NTSC signal processing is 1H including the comb filter, any PIP information and chroma decoding. The main chassis supplies the processed signal to the DM1 in component YIQ format. The YIQ signal is digitized by the DM1 and converted to component YUV format prior to the OSD information being added. The digitized YUV information is then converted to analog component (Y, Pr, Pb) and returned to the main chassis. All further video processing such as color level, brightness, contrast, tint, etc. is performed by the main chassis via commands from the DM1 OSD.

### *Video Signal Switching*

All tuner switching between ATSC, NTSC and DBS is handled directly by the DM1. Switching between the various baseband video inputs is done by the main chassis. Inputs 1,2 and 3 are converted to component YIQ before being sent to the DM1. Component video input, 2H or 2.14, will not be sent to the DM1 but 1H will be. In the DM1 the YIQ signal is converted to digital YUV (Y, Cr, Cb) for handling by the DM1. The signal is then converted to analog YUV and passed back to the main chassis for final processing.

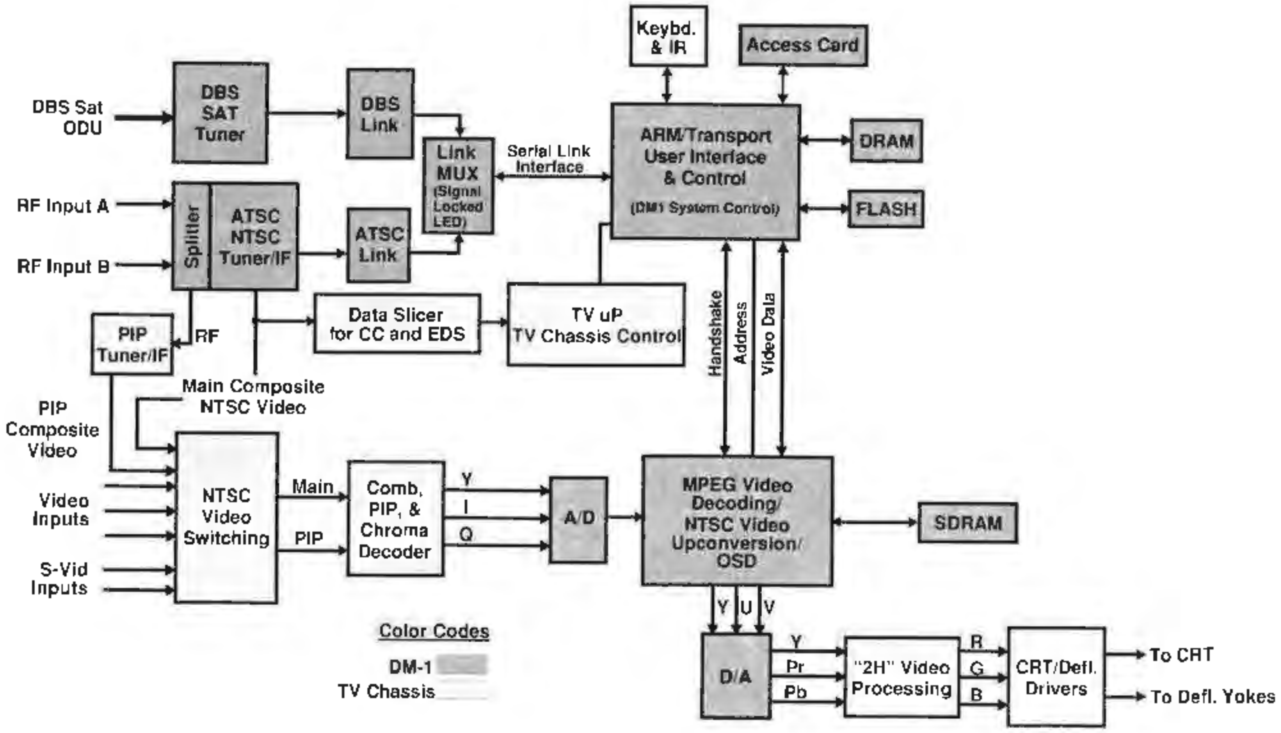

Keybd. & IR
Access Card
DBS Sat ODU
DBS SAT Tuner
DBS Link
Link MUX (Signal Locked LED)
Serial Link Interface
ARM/Transport User Interface & Control (DM1 System Control)
DRAM
FLASH
RF Input A
RF Input B
Splitter
ATSC NTSC Tuner/IF
ATSC Link
Data Slicer for CC and EDS
TV uP TV Chassis Control
Handshake
Address
Video Data
PIP Tuner/IF
RF
Main Composite NTSC Video
PIP Composite Video
Video Inputs
S-Vid Inputs
NTSC Video Switching
Main
PIP
Comb, PIP, & Chroma Decoder
Y
I
Q
A/D
MPEG Video Decoding/ NTSC Video Upconversion/ OSD
SDRAM
Y U V
D/A
Y
Pr
Pb
"2H" Video Processing
R
G
B
CRT/Defl. Drivers
To CRT
To Defl. Yokes
Color Codes
DM-1 ▨
TV Chassis ☐

*Figure 6-1, Video Processing Block*

**TECH TIP**

*In troubleshooting video as with all video signals a standard pattern such as color bars helps the technician in determining if the signal is correct or not. Knowing how the color bar pattern looks on a scope will insure the signal is correct or not.*

## Video Signal Troubleshooting

First connect an RF generator channel 3 or 4, color bar signal to antenna A or B, which ever is selected, and see if signal is present at pins 1, 3 and 5 of J22402. Waveforms should match those in Figure 6-2, 3, 4.

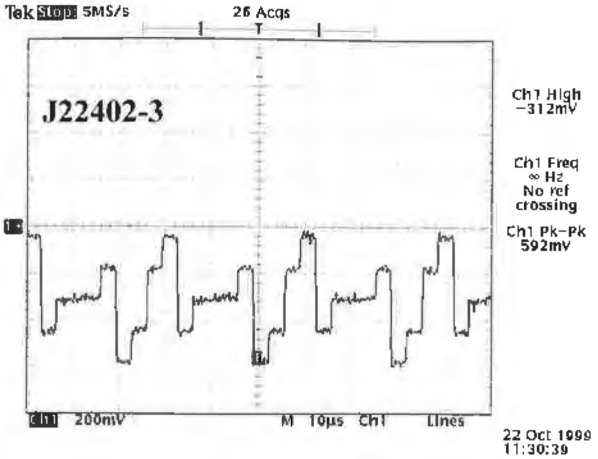


*Figure 6-2, Signal on J22402-3*

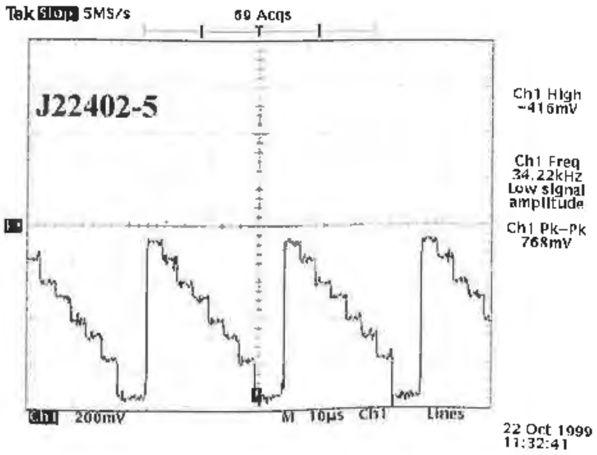


*Figure 6-3, Signal on J22402-5*

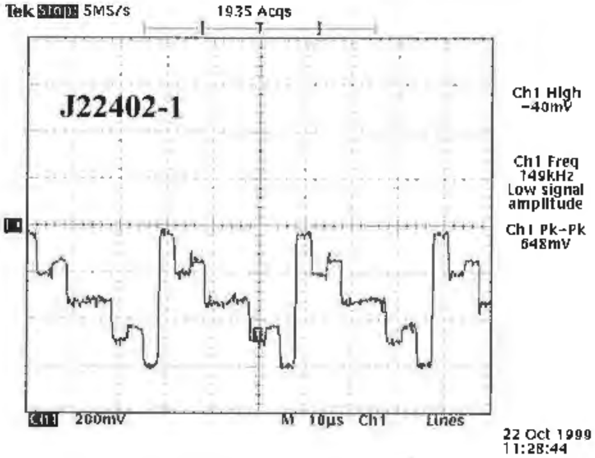


*Figure 6-4, Signal on J22402-1*

***Note:*** *Because signal information varies from location to location no comparison wave forms will be shown for ATSC and DBS.*

Next tune to an ATSC channel and recheck pin 1, 3 and 5 of J22402 for signal. If there is no signal present on J22402, then check signal source. Replace DM1 if signal source is OK.

Last tune to DBS channel and check for signal at pins 1, 3 and 5 of J22402. If there is no signal present on J22402, then check signal source. Replace DM1 if signal source is OK.

Signal in one or more tests indicates DM1 is processing a signal and signal source should be checked. No signal in any test indicates the DM1 is not processing a signal and should be replaced. Using the DM1's own OSD can also give a good indication if the DM1 has output or not.

**TECH TIP**

**Note:** *OSD from the DM1 indicates output from the DM1 is functioning and signal source should be verified before replacing the DM1.*

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